# PRACTICAL ENGINEER

A monthly journal, devoted to the economical generation and utilization of power and the interests of stationary engineers

VOL. XIV CHICAGO, APRIL, 1910. No. 4.


## POWER PLANT OF THE LA SALLE HOTEL

### THE COMPLETEST AND COMFORTABLEST INN OF THE CITY AND RECENTLY PRESIDENT TAFT'S SOJOURN

COLLECT 1,000 people from all parts of the world into 1 building, place about them all the personal comforts known to mankind at the present time, and you have the condition met by the LaSalle Hotel at La Salle and Madison Streets, Chicago, Ill. This magnificent building covers an area of 175 by 185 ft., and contains 21 floors and 2 basements. In architectural design it represents the most artistic and modern practice known to the art; from the bedrooms to the ballrooms, everything in the way of comfort and pleasure has been provided even to the slightest detail.

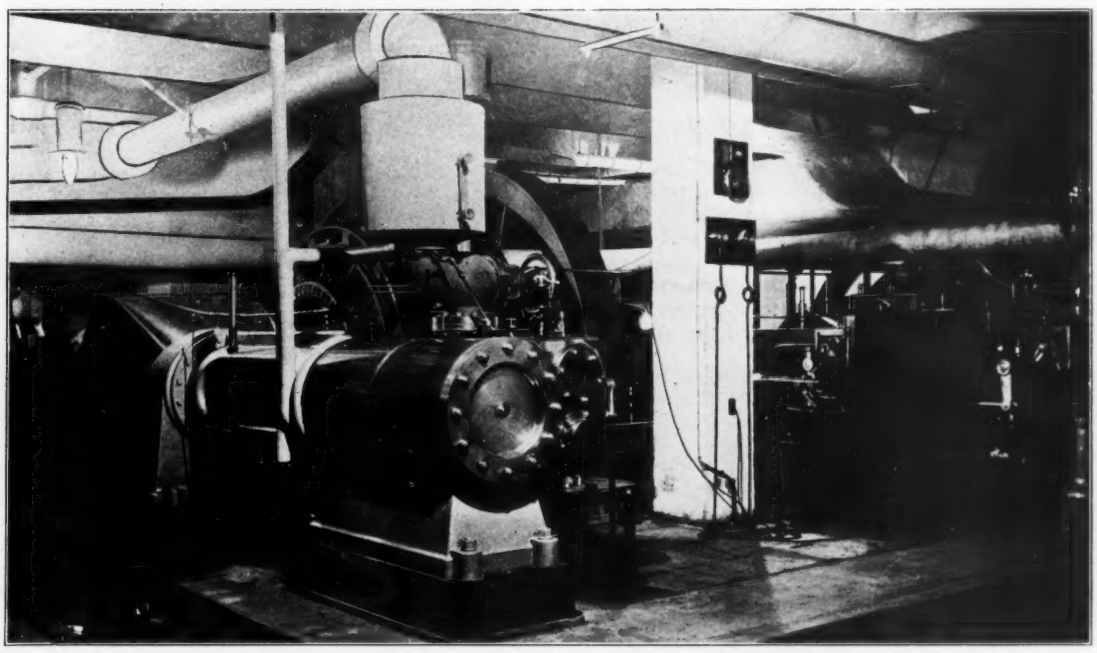

FIG. I. FITCHBURG ENGINE DRIVING THE 500 KW. CROCKER-WHEELER GENERATOR

#### Lighting and Heating

So far as possible each bedroom is supplied with daylight by windows through the outer walls, or into the light court which extends from the second floor to the top of the building. Artificial light is supplied by direct current electricity generated in the power plant. All the bedrooms, offices, and other small rooms are heated entirely by exhaust steam from the engines, while the large dining rooms, banquet halls, lobbies and the like are heated by the indirect system of passing air over steam coils and forcing it to the various parts of the building by means of motor driven fans. Bedrooms are supplied with hot and cold running water, telephones, and with a large part of the rooms a private bath is provided. To protect its guests against fire, each floor has located upon it several reels of hose and connections which can be put into operation at a moment's notice. Aside from this the building is equipped with 2 fire escapes which may be reached from the main corridors.

Annoyance and possible scattering of disease due to the dust raised while sweeping are done away with entirely by the vacuum cleaners which are placed in the power plant with suction tubes extending to the various rooms and halls.

Comfort, during the hot days of summer, is assured in this hotel by the provision of a refrigeration system which will cool the air supply to the main rooms of the hotel as well as furnish ice and cold storage.

FIG. 2. THE LA SALLE HOTEL, LA SALLE AND MADISON STS., CHICAGO, ILLINOIS

The building is equipped with 6 passenger elevators located near the main entrance, 2 service elevators and 1 for freight located in the rear of the building.

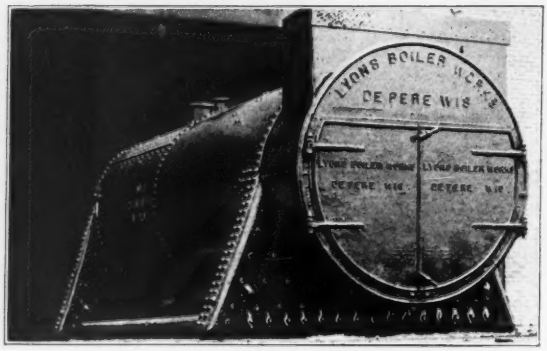


FIG. 4. LYONS SAFETY BOILER BEFORE INSTALLATION

On the top floor are located the laundry, carpenter shop, printing office, store rooms and repair shops, which add materially to the service that a hotel is capable of giving.

### Power Plant

It will be appreciated that a building requiring such a multiplicity of power plant products must have a power-plant equipment furnishing almost everything known to the field. In this building the power plant is located in the sub-basement, and occupies the entire floor. As in all cases of power plants for high buildings, the designers of this plant were limited by the low head room which was available, and the selection and arrangement of machinery was made accordingly.

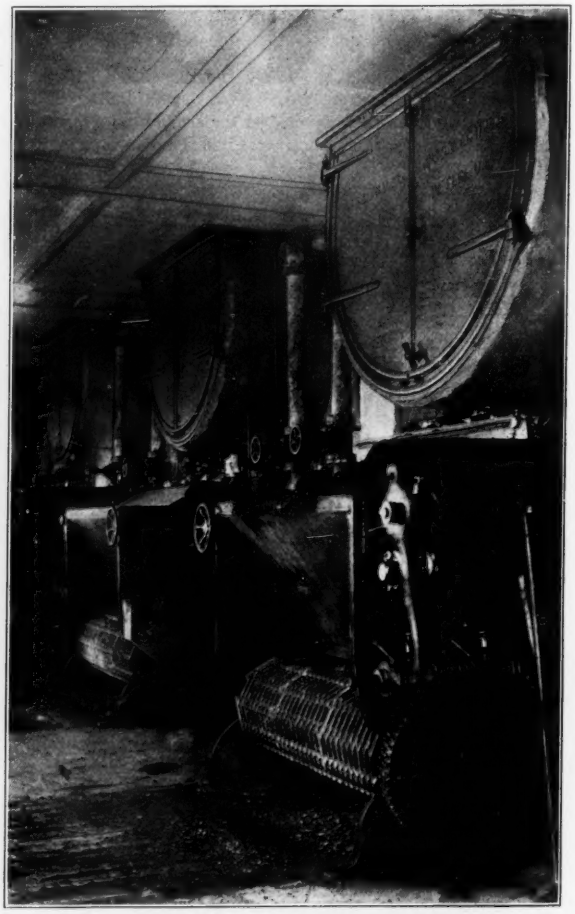

FIG. 3. BOILER ROOM OF LA SALLE HOTEL

### Boiler Room

Steam used throughout the building is generated in a battery of 5 400-hp. Lyons boilers, which are equipped with McKenzie chain grate stokers. This type of boiler is in reality both a water-tube and tubular boiler, and is peculiarly adapted for plants where the head room is limited. The boilers are each 90 in. in diameter by 18 ft. long and contain 188 3.5-in. fire tubes and 20 4-in. water tubes. By this arrangement a large amount of heating surface is obtained without subjecting the boiler shell to an intense heat.

The water tubes are attached to flanged steel saddles which are riveted to the boiler shell as shown in Fig. 4. A hand hole is provided at the end of each water tube, through which it is possible to remove any scale which may collect in the tubes. The great share of the sediment, however, which collects in the boilers, settles in the centers at the bottom of the shell where the circulation is retarded. The blowoff pipe is therefore connected at this point, with a perforated pipe extending the entire length of the boiler. Besides this

there is a blowoff pipe connected to each lower corner of the rear saddle. Homestead straightway blowoff valves are used in these pipes with a globe valve in series for protection.

The water columns on the boilers are Gould's automatic regulators which control the feed water supply and give alarm when the water is too high or low. The steam gage equipment was made by the Star Brass Works and the pressure carried is 160 lb. Two safety valves are provided on each boiler; these are 4.5-in. Ashton valves. For cleaning the fire tubes of soot, each boiler is equipped with a Monarch flue blower which discharges the soot in the direction of the flue gases.

Feed water is injected at the lower corners of the front saddle, in the direction of the flow of the water.

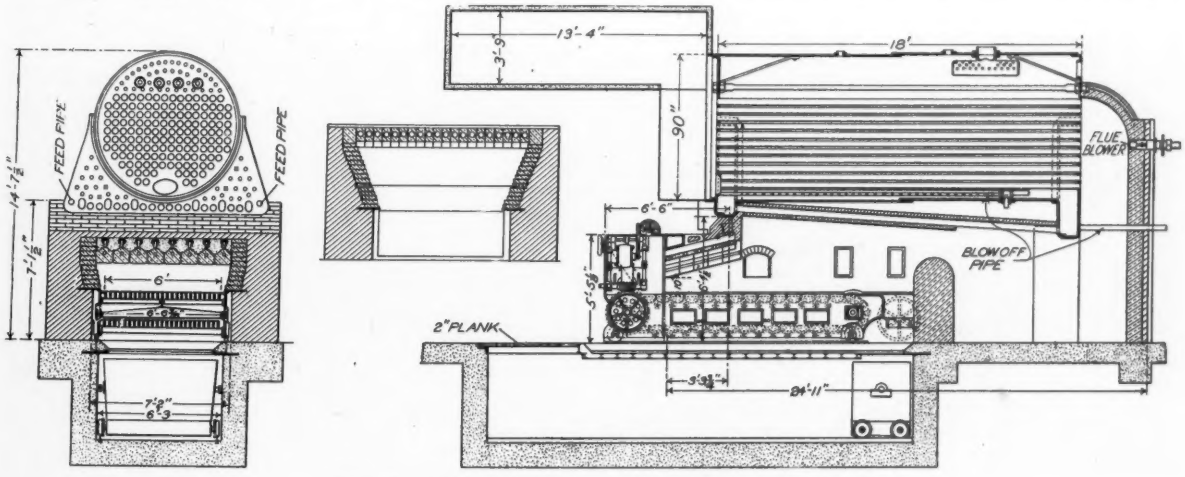


FIG. 5. CROSS SECTION OF BOILER AND FURNACE

Steam is drawn out through a perforated dry-steam pipe, 9.5 in. by 4 ft., to insure dry steam entering the main. The sectional view shows the method of covering the water tubes with tile and split brick, over which are placed 2 rows of asbestos mill board and a coating of asbestos cement. This view also shows the method of bracing the boiler heads.

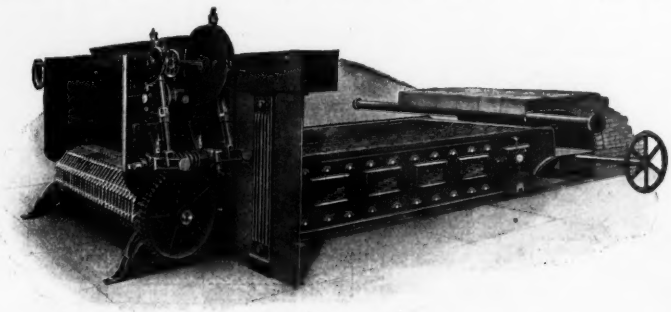

FIG. 6. M'KENZIE CHAIN GRATE STOKER

### Stokers

The McKenzie chain grate stoker, with which each of these boilers is equipped, has a fire surface 6 by 10 ft., the coal being burned on a chain which forms the grate surface, and the general mechanical construction is arranged to be as convenient as possible. The operating mechanism is of the double eccentric type, set at opposite centers, giving the machine a continuous travel, the power being supplied by a direct-current 1.5-hp. Crocker-Wheeler motor. The stoker is provided with a suspended ignition arch and independent air shields on the sides of the machine. At the rear of the stoker is a clinker apron and horizontal dump grate.

Coal is dumped from the alley into the coal bins in front of the boilers, from which it is shoveled into the hoppers of the chain grates by hand. A pit is provided underneath the grate into which the ash is dumped, and from which it is at present shoveled into wheelbarrows and carried to the ash handling device located as indicated on the drawing, provision has been made, however, for doing all this work by machinery.

This ash handling device is the product of the Jeffrey Manufacturing Co., and elevates the ash from the sub-basement to the alley, where it is dumped into wagons.

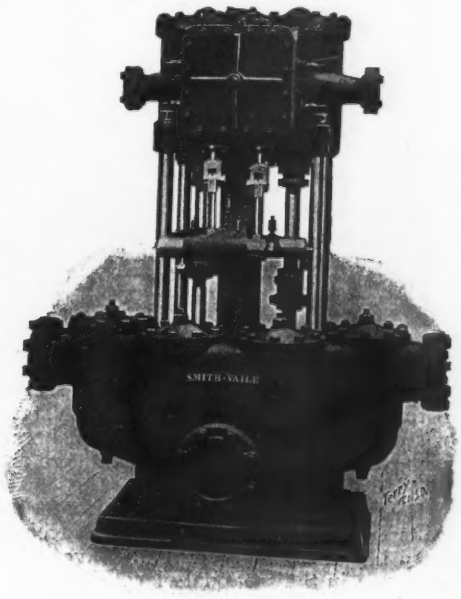


FIG. 7. MARINE TYPE BOILER-FEED PUMP

The boiler breeching extends along the front of the boilers, and varies in size from boiler No. 1 to No. 5, where it is 3 ft. 9 in. by 13 ft. 4 in., and conveys the

flue gases to the smoke stack which has the dimensions 8 ft. 6 in. inside diameter by 330 ft. high above the grates.

### Feed Water Supply

Boiler feed pumps are 2 in number, and are of the vertical marine type made by the Platt Iron Works Co. These pumps are set on masonry foundations and occupy a minimum of floor space. They are made of selected material, bronze fitted throughout and tested to 300 lb. pressure. Constant level of water is automatically maintained in the boiler by the use of Fisher governors on the pumps. Accessibility is given to the valves, springs and the entire valve decks through the horizontal centrifugal type, driven by a direct connected engine.

Feed water is heated by means of a 2,000-hp. Cookson feed-water heater of the open type. The water comes in near the top of the heater, controlled by a balanced water-inlet valve which is operated by a float, maintaining the proper water level in the receiver. It then flows from a special water box to inclined lime-catching pans, and from these to the filtering chamber where the water is thoroughly cleansed by passing through large filter beds.

After having passed through the heating chamber and the filter bed, the water passes to the boiler-feed

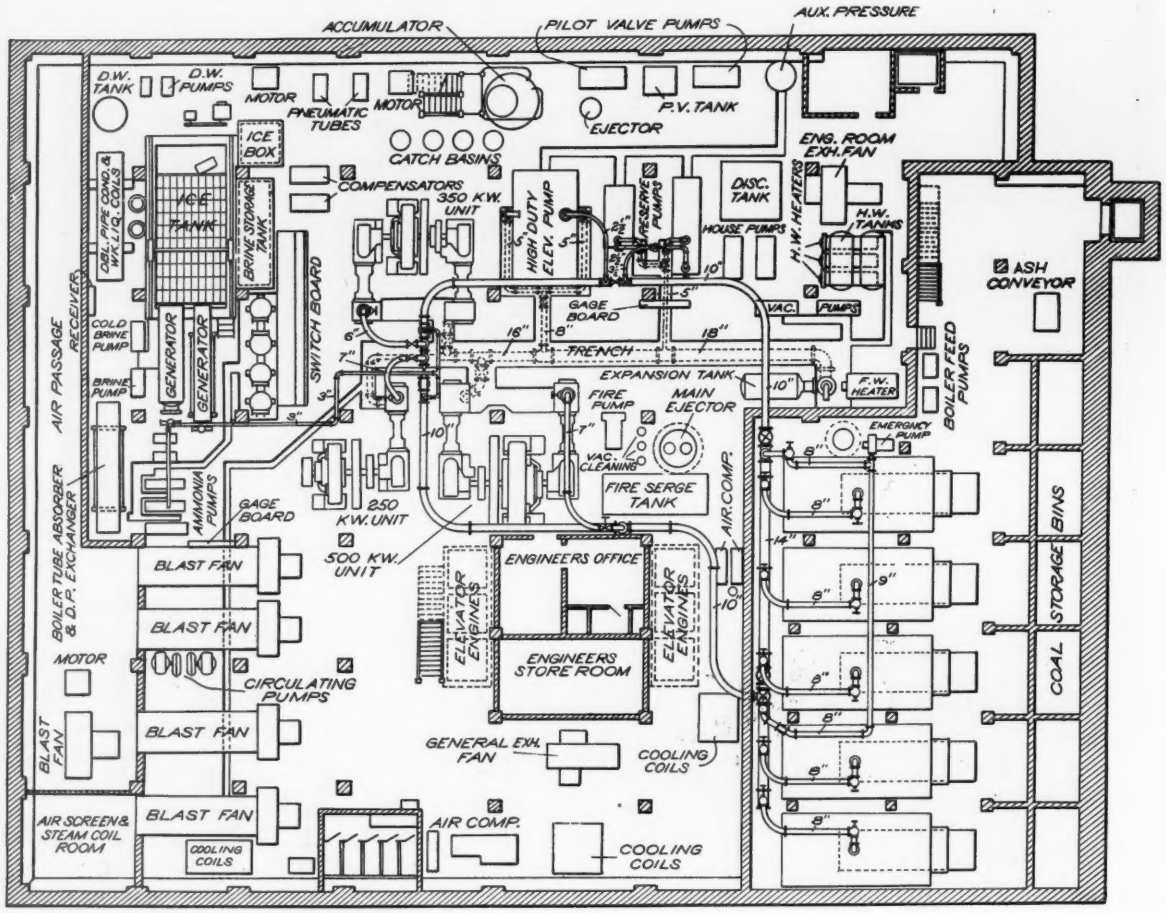


FIG. 8. PLAN OF THE POWER PLANT

large openings provided on top of the water box. The piston rods part at the crosshead, the steam end being of steel and the water end of Tobin bronze. To prevent condensation the steam cylinders are lined with Russian iron.

These pumps draw the water from a Cookson feed-water heater, made by the Bates Machine Co. and located in the engine room, and deliver it to the boilers as shown in the sectional view, Fig. 5, at a pressure of 160 lb.

There is also located in this room a Yeoman's electric ejector and pit pump for discharging the water from the sump into the sewer mains which are above the level of the sub-basement. An emergency pump is also provided for this purpose to take care of any excess water which may come into the plant during a flood or rainy season. This is a Worthington pump of pumps, free from all scale forming material which can be removed by heating the water to the temperature of the exhaust steam. The heater is supplied by exhaust steam from the engines, which passes through an oil separator before entering the heating chamber and, coming in contact with the feed water. A great share of the steam, coming in direct contact with the feed water, is condensed and returned to the boiler, while the remainder is conducted to the exhaust pipe, through the opening at the top of the heater.

### Engine Room

The arrangement of the apparatus in the engine room is the most convenient possible under the conditions of space and low head. The generating units, fire pumps, vacuum pumps, elevator pumps, gage board, feed-water heater and so forth, are placed on

the sides of the main aisle, at the end of which is located the switchboard. The trench containing the exhaust steam pipes is located beneath this aisle, and covered with iron plates.

### Generating Units

There are 3 generating units in the plant, consisting of direct-current Crocker-Wheeler generators, direct connected to Fitchburg 4-valve engines. The largest unit is a 750-hp. cross-compound engine, having 20 and 32 by 36 in. cylinders, running at 125 r. p. m., and carrying a 500-kw. generator. The second engine is rated at 525 hp. and is also cross compound with 17 and 28 by 30 in. cylinders, running at 150 r. p. m., and carrying a 350-kw. generator. The third engine is rated at 375 hp. with a single cylinder 19 by 30 in. and runs at 150 r. p. m.; it is direct connected to a 250-kw. generator. The total rating of the 3 generating units is 1,650 hp. and they are designed to run noncondensing in all cases.

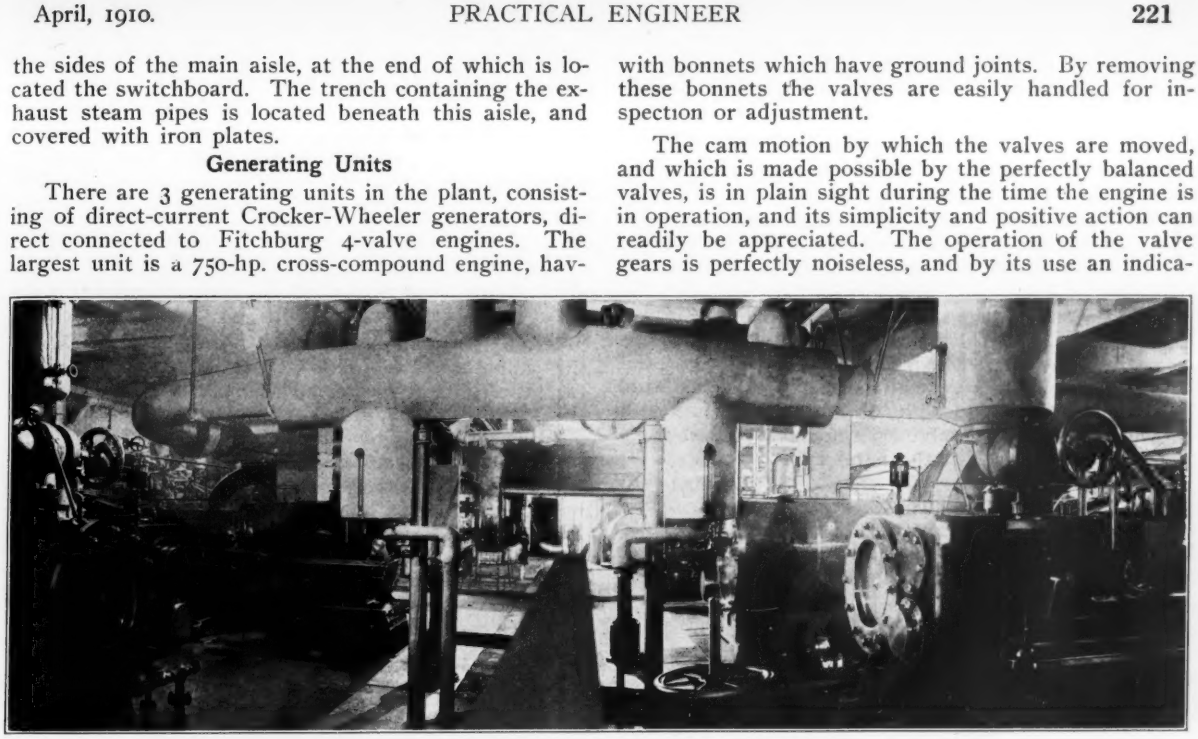

FIG. 9. GENERAL VIEW OF POWER PLANT IN THE LA SALLE HOTEL

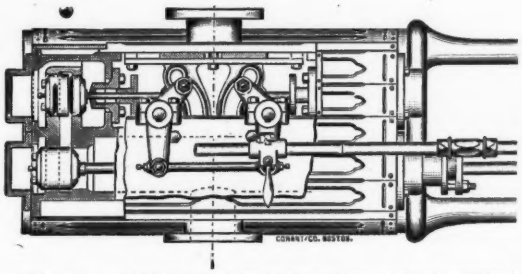

FIG. 10. CAM WRIST PLATE VALVE MECHANISM

The special features of these engines aside from the quality of workmanship and accuracy of design to secure the greatest strength by disposition of material, are the automatic governors, the valves, and the valve mechanism.

### Engine Valve Gear

The governor is of the shaft type, so designed as to have complete standing, as well as running balance, allowing low revolutions, as low as 60 per minute, or higher up to 300 if desired. The fact that the governor passes the eccentric in a straight line across the shaft gives it great strength, and the ability to regulate very rapidly.

The valves are of the balanced piston type, frictionless in action, expansible positively in diameter, and rigidly held when expanded. The valves are covered with bonnets which have ground joints. By removing these bonnets the valves are easily handled for inspection or adjustment.

The cam motion by which the valves are moved, and which is made possible by the perfectly balanced valves, is in plain sight during the time the engine is in operation, and its simplicity and positive action can readily be appreciated. The operation of the valve gears is perfectly noiseless, and by its use an indicator diagram may be secured, which approaches closely to the theoretical diagram.

The valve mechanism has the Corliss wristplate action, with its high velocity of opening and sharpness

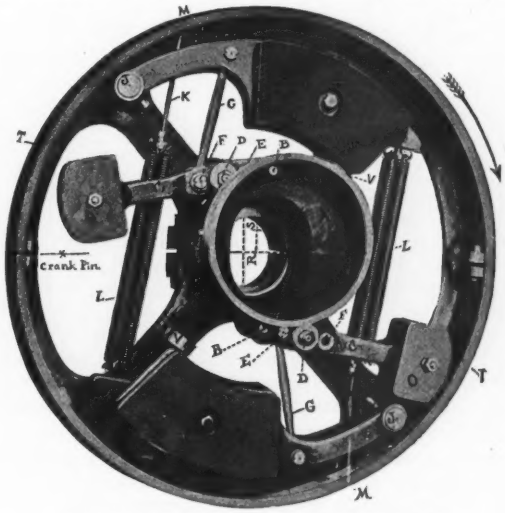


FIG. 11. BALANCED SHAFT GOVERNOR

of cutoff. The admission valves are double ported, giving, with the wristplate action, an exceedingly free admission of steam, the steam valves of both cylinders in each compound engine are driven from 1 governor which varies the point of cutoff in both. The exhaust valves are driven by separate eccentrics.

Steam pressure carried in the main header is from 155 to 160 lb., that in the receiver 30 lb., and the engines exhaust against a pressure of 2 lb. into an expansion tank, from which the steam is carried through the heating radiators or into the feed-water heater.

(Continued on page 250.)

# STEAM ENGINE DESIGN

## A PROBLEM RECENTLY ENCOUNTERED

By L. V. Sanderson

THIS particular case was one of the most interesting that ever came under the writer's observation. There was a pound, and this is how we chased it.

The engine was an 18 by 16 in. horizontal, center crank engine designed to run 250 r. p. m. with 130 lb. steam pressure. It was equipped with an ordinary flat valve having auxiliary steam and exhaust ports and held in place and balanced by an extra heavy backer or pressure plate. The valve was operated by an automatic shaft governor of the Rites type.

### Cylinder Construction

Original cylinder construction was as shown on Fig. 1 from which it will be seen that the piston which was turned 1/32 in. in diameter smaller than the cylinder bore had a chance to be thrown over 1/64 in. each way against the cylinder wall when it came opposite the port at each end of the stroke.

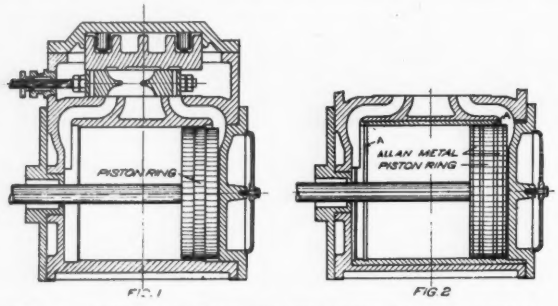


FIG. 1. ORIGINAL FORM OF CYLINDER CONSTRUCTION
FIG. 2. MODIFIED CYLINDER CONSTRUCTION WITH LONGER BORE IN BUSHING

This, however, was remedied by changes as shown on Fig. 2, the cylinder being rebored and fitted with a bushing in which the bore was lengthened so that the body of the piston overtraveled only 1/8 in. at each end. In addition to this, the piston body was turned as near to the bore of the bushing as it was possible to turn it and yet have it run easily. Two Allan metal rings, one either side of the main piston packing ring, were also put in the piston and turned exactly to the bore. Two grooves to prevent the packing rings from forming shoulders are shown at AA.

It is apparent that with this construction there is absolutely no possibility of the piston being thrown over. There were probably a dozen minor changes made between the original construction of the cylinder as first put on the testing plate and the final change described above, and yet during all of this there was not the slightest improvement.

### Remedies Tried

Theory after theory was advanced to no effect. At least 3 new valves were tried out with and without auxiliary ports. The compression, release and admission were changed back and forth by altering the valves and also by shifting the governor wheel on the shaft, the engine was thoroughly lined up again, bearings scraped and adjusted, exhaust was throttled to form a back pressure, sizes of pipes were changed yet during it all, there was that pound in the cylinder just the same.

### Why?

The following causes which were advanced about in order, the piston being thrown over, lack of compression, poor alignment, lost motion, were each in turn apparently rectified without result. The indicator cards obtained were all that could have been desired. Plugs were put under the piston ring to prevent it from collapsing by any side pressure. Holes were drilled in the steam chest cover and tapped in the valve backer or pressure plate and tap bolts screwed into the backer to hold it off its seat and prevent it from deflecting under the heavy steam pressure on its large area.

Finally after all resources had been exhausted and the customer was about to cancel the order, the authorities ordered a new cylinder designed with a piston valve, snap ring piston and no overtravel of the piston past the port. This has not yet been tested so it is not known if this construction is satisfactory.

The pound or click always seemed to me to be a metallic one and seemed to be more in the valve chest than in the cylinder. I recommended that as a last resort, some recognized steam engine authority preferably some technical college professor who is a thorough student of theory, be brought in and allowed to make a thorough test and investigation. I had the idea that somebody could make the engine run satisfactorily with the original steam cylinder and in this view, I was joined by several others who had been interested observers of the case. I will admit, however, that I had no suggestions to make as to how this was to be done.

### Further Dimensions

As a matter of information for anyone who may desire to study this problem, the clearance at each end of the cylinder is 3/16 in. amounting to 6.45 per cent of the piston displacement at each end up to the face of the valve. The backer is 2⅜ in. thick with one longitudinal rib 1.5 in. thick and 5 cross ribs each 1.25 in. thick rising 2⅜ in. above the top of the backer, making the backer practically 4.75 in. thick including the ribs.

The exposed area is 18 by 16 in. equaling 288 sq. in. which with 130 lb. pressure per square inch equals 43,440 lb. total pressure on top of the backer.

The question that I would like to have answered is what caused the knock and could it have been remedied. I would be pleased to answer any questions in regard to the above case as I am anxious to know if there is any solution.

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As to the economy of single-phase and direct-current systems for steam railroads, George Gibbs says that maintenance costs of the present single-phase system will be somewhat higher than for direct current, but eventually they should be about the same. He estimates that about 13 per cent less energy would be required at the power house for the single-phase than for the direct-current system and adding the saving in substation operation, he looks for a saving of 4 to 5 per cent in the total operating cost in favor of the single-phase system.—Scientific American.

# REMINISCENCES OF AN ERECTING ENGINEER—IV

## ASSEMBLING PARTS ON SHAFT

By M. E. P.

AFTER the electrical engineer has the lower half of his generator in the wheel pit we can put one-half of the fly wheel into the pit if the wheel is made in halves. If it is a built up wheel we need not assemble it as yet but can do considerable other work before the wheel is touched. The chances are that a fly wheel for an engine of the size we are erecting will be built in sections, one to each arm and the hub placed on the shaft in the shop. In this case we will get the receiver placed next.

The receiver brackets are bolted to the back columns and after they are put on we shall have to plan how to handle the receiver. It is so long that it will not be easy to sling it from the crane although it can be done by means of a couple of slings and a spreader. Probably the better plan will be to put up an extra chain block in such a way that we shall have one over each end of the receiver as it lays on the runway under the door through which it must be raised. We can

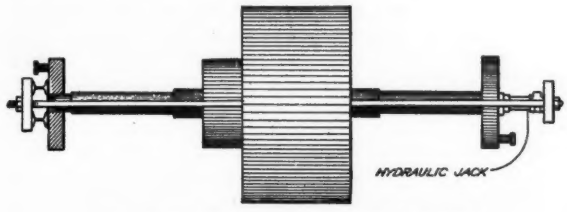



FIG. I.—METHOD OF PULLING ON DISK

hook on at either end and lift it to the floor level and then make a temporary runway to the back of the engine so that we can run into a position convenient to lift directly to its place. We can then shift our chain blocks and hook on to the receiver at points near each end. If any of the valve gear brackets bolt to the receiver, we had better have them put in place before hoisting it up as it is easier to work with the receiver on the floor and the added weight of the brackets is insignificant.

All the brackets that are attached to the back columns are next cleaned and bolted on and the rocker arms that go on them put up and we shall be ready to turn our attention to the shaft. If the armature has to be forced on the shaft, the electrical engineer has been doing that while we were at work on other things and is ready to let us have the shaft to force the disk on. The hub of the wheel has been put on in the shop but the disk has been left off in order that the armature can be pulled on so we have to put this disk on the shaft ourselves.

### Necessary Equipment

Very likely we can use the rigging the electrical man had if we are willing to stand a part of the expense of it which is only fair. This rigging will consist of some heavy I beams about 2 ft. longer than the diameter of the disks, some log rods threaded for a foot or so on each end and plenty of washers that will slip on the rods. The number of I beams and rods will depend on the way we decide to build the rigging. My own preference is for 4 I beams and 2 large rods.

To rig with this equipment, the 2 rods are placed one on each side of the shaft and parallel to it, with an I beam resting across the disks in such a position that the ends of the rods will lay across the ends of the I beams. The other 2 I beams are laid across the tops of the rods just above the lower beams and then a heavy strap is slipped over the ends of the rods so that it bears on the beams. Put pieces of iron of equal thickness against the hub of each of the disks so that when the strain is put on the bolts none will come against the rims of the disks. It is not safe to pull on the rims as there is too much danger of cracking.

Have a temporary key made to fit the keyway in the shaft and have a large hole drilled and tapped in the end of it, so that a bolt can be screwed into it after the disk is on, and it can be pulled out easily. The key should fit loosely top and bottom and only hand tight on the sides. It is used merely to guide the disk while it is being pulled on so that it cannot turn on the shaft.

### Pulling Disk on Shaft

We are now ready to do the actual work of pulling on the disk and have entered the shaft into the bore with our guide key in place. Have the inside of the bore and the shafts where the disk fits well painted with a mixture of white lead and oil and take a strain on the rods by turning up the nuts. See that the disk is perfectly square to the shaft by using a steel square against the shaft and the hub. As soon as the disk is started on the shaft for about 1-8 in. the supports under the disk should be removed so that it hangs free of everything except the shaft and the pulling rig.

By turning the nuts on the rods to take more or less strain as it is needed, the disk is kept square to the shaft and it should be closely watched until it is well on the shaft to see that it does not get out of true. Be very careful about this as it may prevent a lot of trouble later on. It is well to have 2 gangs at work screwing up on the nuts, one at each side, having them keep time so that each nut is turned an equal amount. After the disk is well started on the shaft, keep the work going along steadily and do not allow it to stop until the disk is up against the shoulder on the shaft. If it is allowed to stand for a little while, it will be found very difficult to get the disk started again, it "freezes" on the shaft and a great deal more force is necessary to start it than is required to keep it going.

### Difficulties Encountered

Sometimes, in spite of all one can do, a disk will stick and a lot of trouble will be experienced in getting it on. As an illustration of a case of this kind, and the means taken to start the disk that has stuck, I will describe an incident that occurred in a southern city where I was erecting 2 large engines.

I had been asked to take charge of the pulling on of the generator armature as the purchasers had bought the generator with the understanding that they do all the work of erecting it. When the armature came, they found it so large that they were rather afraid to try the job as they had no one who had any experience in such work. My firm had sent me a 150-ton jack to pull the disk on with and I used that to get the armature on.

It went very nicely, requiring about 125 tons, and then I got the disk started. The jack was not in the best of shape and worked pretty hard when pulling

from 125 to 150 tons. I had a gang of negroes and they didn't like the work of pumping that jack at all. The disk was going along rather hard, about 130 tons, and as it got near noon the gang wanted to stop and eat. The disk was within about 0.25 in. of up and I told them that they could not leave till the disk was up to the shoulder. Just as the whistle blew for noon, I was called away for a minute for something and left them alone with instructions to keep on pumping till I got back which would be in the course of 2 or 3 minutes.

While I was gone, the contractor who was furnishing the help and doing the hauling, came into the plant

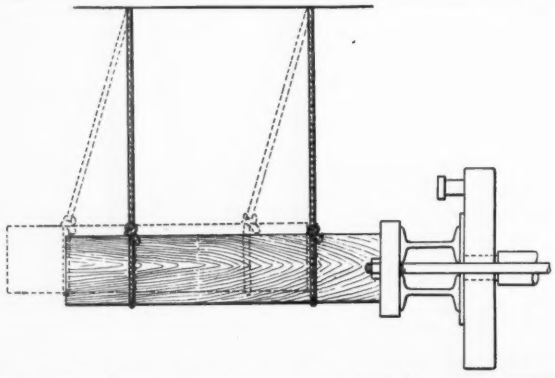


FIG. 2.—BATTERING RAM USED TO OVERCOME DIFFICULTY

and told the men to go to dinner. Needless to say, they went on the run and when I returned I was just in time to see the last one going out the door on the jump. I tried to call them back, but it was no use, and then I took it out on the contractor.

Finally, in desperation, I went to an old machine shop and looked through their junk pile and found the drop head of an old pile driver. I had that hauled to the plant and hung up in place of the timber. All the while I had the torches going and the disk had become quite warm. I had the gang pull that old pile driver head way back as far as we could get it and then let it go. It came down on the I beam with a rush and, bang, up went the disk to place.

What had hapened was that the iron had expanded and loosened on the shaft enough so that the heavy jar was enough to start it and the tension on the bolts was enough to pull it into place when it once moved. The whole job took nearly a week when if the men had kept to their work the chances are that another half hour of pulling at the time they quit work would have put the disk up to the shoulder. When you once get a job of this kind going, don't stop until it is done.

After the disk is in place, the rigging may be removed and if a jack has been sent from the shop, it can be sent back at once as we shall not need it again. The remainder of the rigging can be sold if we have had to buy it. One cannot get nearly as much as it is worth but a little is better than nothing.

### Fitting the Key

When the rigging is out of the way, the keys will have to be fitted into the disk and this is a job that calls for a machinist unless the erecting man has the time to do it himself. The keyways must be filed true on their edges if they are the least out and then the key is driven in for a short distance and pulled out and draw filed where it shows a bearing. This is done repeatedly until the key will drive to within a short distance of its full length. A last, careful fitting is given it and then it is driven home with a heavy sledge. It is then

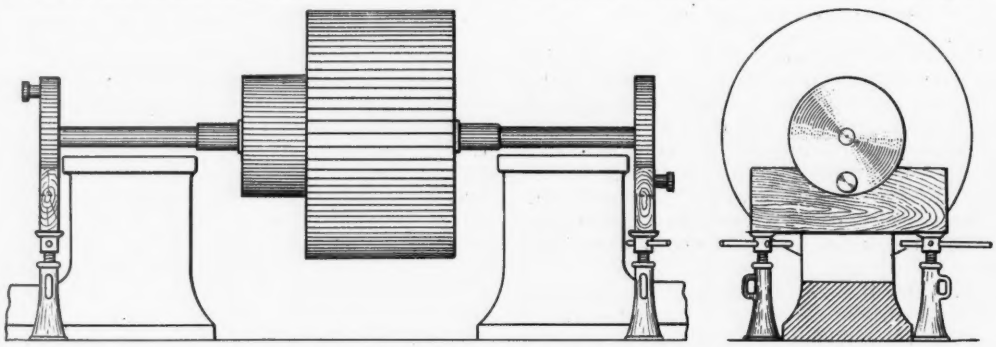


FIG. 3.—LOWERING SHAFT INTO BEARINGS

When they came back after dinner, the disk had set and we could not start it with the jack. I took the jack out and tried the screws but they would not move it. Then I got a heavy timber and after putting all the strain on the screws I could I had the timber hung from a long rope in such a way that we could pull it back and strike a heavy blow with the end of it on the I beam against the disk. That would not move it. I got some more rods and pulled up on them till I buckled the 24-in. I beams and then mauled the disk with the timber. Still nothing doing.

All this had taken a day or two and that last 0.25 in. commenced to look decidedly large. I went around to various places in the city and borrowed as many blow torches as I could get and set them around the rim of the disk and kept them burning until the disk got quite hot. From time to time we would try the effect of a few blows with our timber but the disk would not move a particle.

cut off and the end finished with a file and emery cloth.

The key as it is sent from the shop is about 2 ft. or more longer than will be needed and one end is turned up at right angles so that it can be struck with a sledge and driven out. A heavy timber is braced under it so as not to bend it while it is being driven out of the keyway.

### Placing the Shaft

After the keys are fitted the shaft can be put into the main bearings. See that the oil wells in the bearings are perfectly clean and put in the shells. If the shaft is too heavy to handle on the crane, build a runway so that the shaft can be rolled over the bearings and then lift it by means of jacks. Hydraulic jacks are the best if they can be had, otherwise screw jacks must be employed. Only these styles of jack are at all admissible for this class of work. The various kinds of ratchet tacks are too uncertain to risk such a heavy weight on.

A very good plan in lowering the shaft is to put heavy timbers just outside the main bearings and at right angles to the shaft and have 4 jacks, one under each end of the timbers, so that all the weight of the shaft can be taken on the 2 timbers and they lowered slowly until the shaft seats itself in the bearings. As the shaft comes down, it will be necessary to land it once or twice in order to get blocking from under the jacks as it would not be safe to use a jack long enough to lower through the entire distance at one setting.

A good way to land the shaft is to put blocking under the disks and then the entire length of the shaft between the bearings is free and we have plenty of room to work. By using 4 jacks we can guide the shaft back or forward as is needed by lowering one or more of the jacks ahead of the others.

I have seen erecting men lift a heavy shaft with an armature on it by placing a jack under the crank pin, but this should never be done as there is too much risk of accident. It is always a great deal better to be sure than sorry so let's be careful about our work and handle things so that we shall not have any accidents, either to the engine or the men working on it.

# PROPOSED LARGEST POWER DAM IN THE WORLD

## THE PROPOSITION AND PRESENT SITUATION

By C. L. Vestal

IT is proposed to transform the energy of the fall of the Des Moines rapids of the Mississippi River, between Montrose, Iowa, and Keokuk, Iowa, into electric energy, and to transmit this energy over the surrounding country to various points of consumption for manufacturers, small power users, lighting, etc. It is considered that this energy can be profitably transmitted a distance of at least 150 miles from the central station. There appears to be a market in sight for from 100,000 to 150,000 hp.

For many years such a project has been dreamed of and worked for, and in February, 1905, Congress granted the privilege to the Keokuk & Hamilton Water Power Co., its heirs or assigns, to construct a dam across the Mississippi River at the foot of the Des Moines rapids, between the cities of Keokuk, Iowa, and Hamilton, Illinois, stipulating only that the work must be begun within 5 yr. from the date of the franchise, and completed within 10 yr. from that date; also that in lieu of the Des Moines Rapids Canal, 7 miles long, with 3 locks, all of which will be flooded, the company should construct and maintain, under the supervision of the War Department, an adequate lock and drydock.

Agitation of the proposition was continued with more or less success until it fell into the hands of Engineer Hugh L. Cooper of New York, and was pushed by him to a head; actual construction was begun January 10, 1910, on the Illinois shore.

### The Practical Problem

In constructing a dam across the Mississippi River at this point there seem to be no peculiar or especially unusual problems. It is unique only in view of the large scale of operations. There are, of course, the usual problems of providing for floods and ice, and the structure will be such as to do this adequately. The main spillway of concrete will extend in a straight line across the Illinois bottoms and river from the bluff, at right angles to the channel, for a distance of 4400 ft. The upstream side of the spillway will be vertical, while the downstream side will slope from the crest in a parabolic curve. The structure will be 43 ft. wide at the base, and 37 ft. from base line to crest. It will,

FIG. 1.—PROPOSED LOCATION OF DAM SHOWING EXTENT OF BOTTOM LANDS TO BE CROSSED. POWER HOUSE LOCATION INDICATED BY CROSS

of course, be set into the bed rock of the river to a depth of from 4 to 7 ft., varying with the contour.

On the top of the spillway 21 ft. above its crest will be built a superstructure braced by concrete piers on the upstream side, each 8 ft. wide and spaced 30 ft. apart, making 116 openings in the whole stretch of 4400 ft. It is purposed to put floodgates in these openings and to control them by means of electric lifters, which will be run out from the powerhouse upon 2 tracks built upon the superstructure. The whole widtl across the top of the superstructure is 29 ft.

FIG. 2.—SWEEP OF RIVER ABOVE LOCATION OF DAM

### The Power House

At the Iowa end of the spillway it meets another section of the dam at an angle of about 75 deg. with its own continued line. This section extends downstream nearly parallel with the shore for a distance of 1400 ft., and upon it the powerhouse will be built, with the triple turbines underneath.

Even with the lower end of the powerhouse, and between it and the shore, will be constructed the new lock and drydock. The present locks and offices, and indeed the whole canal, will be flooded to a depth nowhere to exceed 25 ft.

Beginning at the upper end of the powerhouse and extending northwest in a large curve slightly toward the Iowa short, and at angle of about 75 deg. with the continued line of the spillway, will be the ice and debris guard, for the purpose of turning all this matter away from the turbine sluices. This guard will be about 2800 ft. in length.

As can easily be understood, the gates in the superstructure above the spillway provide for the floods, the extreme range of rise and fall of the river at this point being not more than 20 ft., and averaging much less. When the river is low, the floodgates will be closed to keep the surface of the water above the dam at a constant level; by manipulating the floodgates, the level will be made practically uniform at all stages of the river. It is not intended that any water shall pass over the superstructure at any time.

Most of the rock needed will be quarried on the ground, from the hillside at the east end of the dam. This quarrying has already been going on some time, also the excavation work of removing the alluvial soil at the foot of the bluffs is proceeding rapidly, although the filling of the excavation with water is making some trouble. This soil must be removed to bed rock, which at this point is of the solid Keokuk limestone, thus furnishing a most excellent natural foundation for a massive and permanent structure.

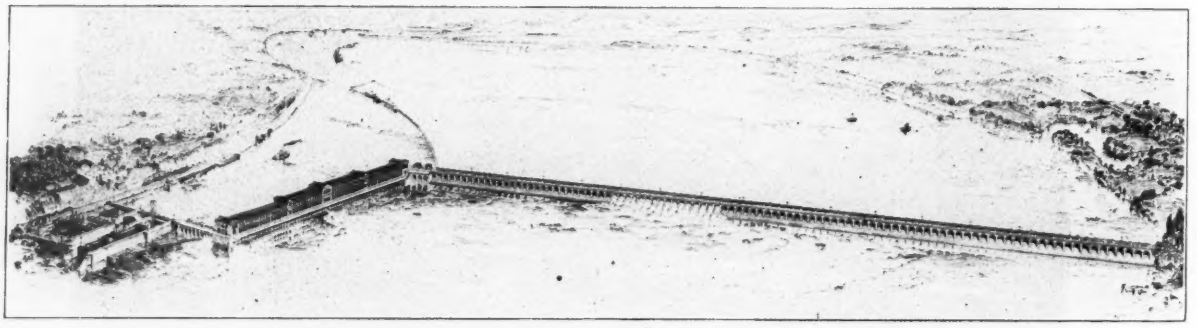


FIG. 3.—DRAWING TO SHOW APPEARANCE OF COMPLETED DAM

Approximately 10,000 acres of rich bottom lands above the dam will be overflowed. There will thus be created a lake over 30 miles in length and anywhere from 0.75 mile to several miles in width. The rapids as such will be done away with and river navigation will be greatly improved. It is estimated by the engineers that if the work goes on normally, as is intended, it will require approximately 3 yr. for its completion.

For the photographs, Figs. 1 and 2, the writer is indebted to H. M. Anschutz of Keokuk. These show clearly the character of the land which will be flooded and the Des Moines rapids canal, which was built by the government at a cost of $5,000,000 and which will be entirely flooded.

# PUMP VALVES

By W. E. Sanders

IT is better in choosing valves not to accept the claims made by the salesman unless you know him personally and know his statements are correct, and then you will find that the better grades of valves cost more and will give the better service while the cheaper valves cost less and wear out more quickly.

For condensers a soft, tough valve must be used. This is because there must be no leakage, not only of water but of air. The temperature may run as high as 212 deg. For marine service the valve generally used is a red valve. There is no particular reason why this should be red, a gray valve can be used and is used as successfully and possibly with a little better success. The requisite, however, is a certain degree of softness and toughness.

For special service, valves are sometimes made with a cloth insertion but rarely with a wire insertion. Generally speaking, there is no gain in using a cloth insertion and few valves are made that way. These cloth insertion valves, when used, are generally used in mining pumps or where there is a large amount of sharp cutting grit present.

### Valve Failures

Valves fail generally for one of 3 reasons: First: The quality of the valve may not be sufficiently high. This we have spoken of in the March issue.

Second: The valve may have been subjected to a temperature higher than that for which it was designed. A valve which is intended for cold water or for warm water when used on hot water becomes too soft and as it returns to its seat it is forced too strongly against the grating and is gradually forced into the grating. This does not have to continue very long before the valve breaks in pieces and generally the break is along the edge of the grating. Usually this breaks out a piece of the valve in the form of a sector or wedge shaped piece.

Third: A valve may be used for a pressure much higher than that for which it is designed. This occurs when a valve which is quite thin is used on a high pressure, and particularly where no guard plate is used. In such a case the valve has not enough stiffness and it is forced through from the back of the valve into the opening of the grating. If a guard plate were back of the valve this could not happen as readily, as the guard plate being stiffer would distribute more evenly.

When a valve is taken out and shows depressions in the back and in front shows that it has been forced through the grating, you can immediately conclude that it has been used without a guard plate under high pressure, and perhaps, also, a valve was used which was too soft at the start. To correct such a failure it may be necessary to thicken the valve or to use a guard plate, or to use a harder valve.

For special valves special compounds must be used. For gritty water it is best to use a valve which is quite expensive but which is tough. A tough valve will allow a bit of sand or grit to indent it for an instant, but as soon as the way is clear it will throw off the grit. On the other hand if a valve has not this toughness and catches some grit between the valve and the seat, the grit will cut into the valve and after a short time it will wear away or break away. This has been demonstrated thoroughly by the service required of valves in slip pumps, such as are used in potteries and in pumps which have to handle gritty or sandy water.

For pumps which handle water containing oil, it is necessary to have a special compound which resists the action of the oil. As a general rule, oil will rot rubber quickly. In fact it will rot any rubber soon or later, and the ordinary valve would not give good service where much oil is present. Manufacturers of valves, however, have certain compounds which will resist oil much longer than the ordinary compounds, and when pumping any oily liquid a valve should be obtained adapted to the purpose. This is also true of pumps which handle acid water or lime water.

In ordering valves it is best to decide on one grade and stick to that. It is a great temptation, particularly to purchasing agents to try to gain a few cents by purchasing valves which have the same color, and apparently about the same consistency but which are 1 or 2 cents cheaper per pound. Repeatedly, users of valves have found that this has resulted in a break down due to a valve which was made with a large proportion of rubber substitutes and little real rubber in the compound. The old rule that "the best is none too good" applies to valves with a peculiar force.

### Vavles of Peculiar Shape

There are a few valves now used to which the foregoing remarks will apply in general, but which are made in a different form. There is the flap valve which is made in the form of a flap, generally rectangular, one side being bolted down and the valve lifting like a hinge. These valves are not used under heavy conditions and are used in the older type of machines. The weak point of these valves is generally at the hinge portion where the valve is subjected to bending at every stroke.

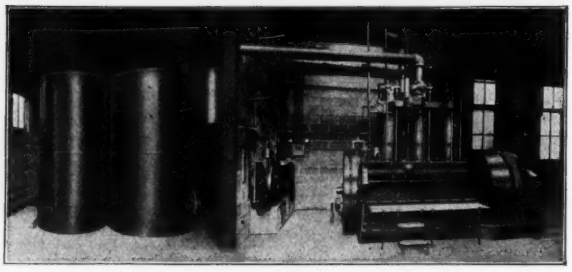
These valves are rarely used for high pressure or for hot service. They are generally soft and often have a ply of cloth running through them which increases the length of life of the valve, particularly at the hinge portion where the bending occurs frequently.

Some valves are constructed with a brass guard which is in the form of an inverted cup. The rubber valve in this case is forced back around this cup by the liquid. This is a type of valve which is being rapidly displaced by the disk valve and is a type which gives particularly hard service to the valve. The valve is bent frequently and should be of tough quality. A rubber valve for use in a valve casing of this kind generally costs more because of the increased toughness.

Another type of valve which is used to some extent is a ball valve in which there is no grating. The sides of the seat are beveled. The valve itself is in the form of a ball or sphere and a brass cage is over the top of the valve to prevent its being displaced and to guide it back into position on the seat.

There are other forms of valves but the use of them is becoming less and less, the disk valve taking their place because in those the rubber disk is used simply to form a soft seat and is not subjected to a constant bending motion. If properly used with a guard, a valve can be reground and used over again a number of times and then after being reversed it can be used again for a like length of service. It is better, however, to study the conditions carefully and not pick a valve hurriedly, and in this way see to it that a valve is sufficiently stiff for the pressure against which it is to be used and that it is of the right degree of hardness for the temperature of the liquid in which it is to be used.

Gas Producers



And Engines

# UTILIZING THE EXHAUST OF COMBUSTION ENGINES

## THE GAS TURBINE FOR LOW PRESSURES

By Geo. H. Murdock

With all the refinement of the gas and gasoline engine, the waste of energy by way of the exhaust pipe still continues to be very great. In Europe some efforts have been made to retrench in this direction, but in this country with 1 or 2 exceptions little has been done, although it is believed that the desirability of improvement in this field is generally recognized.

Long before the exhaust steam turbine had received any serious development spasmodic attempts were made to apply the exhaust of engines to accomplish useful work, and the records of the patent office show a steam engine designed as early as 1835 where the steam was exhausted onto a bucketed wheel. The cost of fuel at that time was not great, however, and

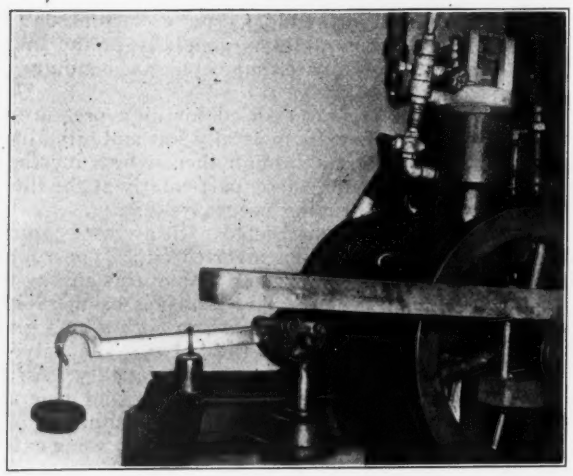


FIG. 1. 5-HP. GASOLINE ENGINE WITH TURBINE EXHAUST WHEEL WITH TESTING APPARATUS IN POSITION

it is not shown in the accounts that have come down to us that the inventor gained anything, not even glory.

The increasing cost of everything that goes to make power in these latter days has served as an incentive for strenuous efforts to obtain economy of operation of both steam, and combustion engines. The low-pressure exhaust steam turbine has lately been developed in spite of much groaning, and wagging of heads by the engineering reactionists to a point where it is doing valuable work, and there is no reason why the combustion engine should lag so far behind the steam engine in the lines of development indicated except that the problems involved in obtaining power from the exhaust of the combustion engine are not so well understood.

### The Problem

The difficulties surrounding the production of power from the exhaust of combustion engines are different from those encountered in the uplift of the steam turbine for the following reasons:

Exhausting into any device from which the gases cannot immediately issue without what is known as back pressure on the primary cylinders is attended with such a loss of power as to eliminate entirely any gain from the use of the secondary element, and many failures have resulted in designs where this was attempted. Besides, the highly heated gases issuing

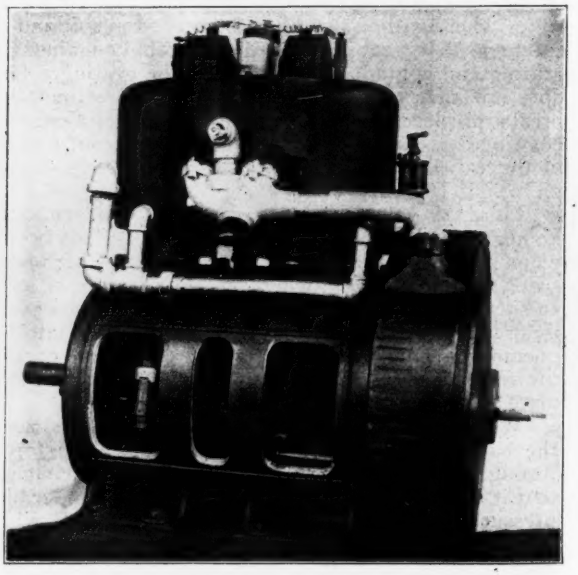


FIG. 2. 15-HP. 2-CYLINDER GAS ENGINE WITH EXHAUST TURBINE SHOWING AIR INTAKE AT ROOT OF EXHAUST PIPE AND BLADES CAST ON RIM OF FLYWHEEL

from a gas engine cylinder are light as compared with steam, and any attempts to utilize these on a rotor of the steam turbine type have been met with discouraging results.

Gasoline engines have been compounded by the method used with reciprocating steam engines, with some degree of success, but the great additional expense of building the engine, complications in the way of moving parts that required lubrication, and other

attention, besides the increase of size, and weight, has militated against such construction. The method of utilizing the exhaust described in this article is, however, of such extreme simplicity as to deserve attention.

### The Action of the Turbine

Exhaust gas coming from the cylinders of the engine is led to a turbine wheel of special construction, and different from anything heretofore attempted as the area of the practically continuous passage around the rotor is so great as to preclude any possibility of back pressure on the primary cylinders. Cold air is also introduced into the exhaust pipe to increase the specific gravity, and therefore impact value of the gases, and in this way every effort is made to utilize the heat as far as possible before the gases strike upon the turbine.

After each cylinder discharges, the air from outside is automatically drawn into the root of the exhaust pipe where it is greatly expanded, and at the same time contracts the very hot gaseous discharge from the engine cylinder at the next succeeding opening exhaust valve. This momentary action decreases the volume of the exhaust product, and with the shrinkage in volume there is necessarily decrease in velocity giving the moisture laden air drawn in from outside time to expand greatly, and by the time the mixture reaches the turbine it has increased in volume, and velocity, is heavier, and is therefore of greater impact value, than the original issue from the exhaust valve.

Admission of air into the exhaust pipe also reduces the temperature of the gases flowing toward the turbine to such an extent as to keep the pipe, and the flywheel of which the turbine is composed, as well as the case comparatively cool. When the mixture of burnt gas, and air reaches the exit of the case its temperature is not much above that of the surrounding atmosphere, and it has not the detonation characteristic of gas engines.

Two engines as shown in Fig. 1 each 5 hp. have been built, and 2 of 15 hp. as shown in Figs. 2 and 3. Another smaller engine was also constructed but as no reliable tests were made it is not described in this article.

### Tests and Results

Tests on the type of engine shown in Fig. 1, as with all tests, have been made with great care. The tests were started with the water in the cooling jacket at 130 deg. F. and the readings taken when it was at 180 deg. The gasoline was tested and of the same quality throughout the trials. The brake was water cooled by a stream running on it, and to secure accuracy even the lubricating oil, and sparking batteries were given attention.

Out of 28 successive tests of the power of this particular engine the lowest power gain with the engine exhaust passing through the turbine was 15 per cent, and the highest gain was 18 per cent with an average for all the trials of 16.66 per cent gain for the turbine method over the same engine running at the same speeds and under exactly the same conditions exhausting through an exhaust pipe 7 in. long into the open air. It is a well known fact that with the average muffler there is considerable back pressure, in some cases amounting to as much as 15 per cent or more, and automobile engines are commonly equipped with a muffler cutout so as to obtain more power from the engine in going up hill. Engines of this class should therefore give, using the turbine here described, at least 25 per cent gain over the power they give as usually run.

It is impracticable to run either gas or gasoline engines without a muffler, and in many localities stringent laws prevent even the use of the muffler cutout on automobiles.

It has been found that the larger the engine, and the larger the number of cylinders the greater proportionate gain in power is obtained, thus in the engines shown in Fig. 2 the gain averaged over 22 per cent, and it is believed that, with engines having 4 or more cylinders, a still greater gain would be shown.

Use of the turbine has further shown a greatly increased steadiness of operation, very noticeable in testing with the Prony brake. The tests on the engine shown in Fig. 1 were made at 300 r. p. m. With the open exhaust, if the pressure was applied so as to bring the speed of the engine down to 250 r. p. m. the

FIG. 3. PUMPING ENGINE WITH TURBINE ATTACHED

engine would stop, while, when the turbine was assisting it, the speed could be reduced as low as 150 r. p. m., and the engine still run.

### Turbine Construction and Action

In Fig. 4 is shown the construction of the turbine. It will be seen that the rim of the wheel is divided into a large number of chambers all opening into each other. The wheel runs in a case, and the exhaust passes in a zigzag course from the entrance as it comes from the engine cylinders to the exit where it reaches the outside air.

Besides its function as a power producer the turbine as has heretofore been stated acts as a muffler, but without the back pressure, and therefore destruction of power inseparable from the stationary muffler, unless of excessive size. With the ordinary muffler, explosions sometimes occur, often with disastrous re-

sults, and on automobiles especially, they are wrapped with asbestos mill board to keep the excessive heat from the adjacent parts of the chassis. With the exhaust turbine, however, muffler explosions are impossible as the rapidly revolving wheel quickly clears out any live mixture, and the introduction of cold air into the root of the exhaust pipe, with the large area of the case prevents any heating comparable to that of the stationary muffler.

In all the engines built the wheel itself has never shown any disposition to heat the journal bearings of the crank shaft, the path of conduction through the spokes being too small to transmit the temperature of the rim of the wheel which has never been known to be so hot but that the hand could be laid on it. The only place on the case where heat of consequence has shown has been just below the entrance of the exhaust pipe from the cylinders, and this is easily taken care of

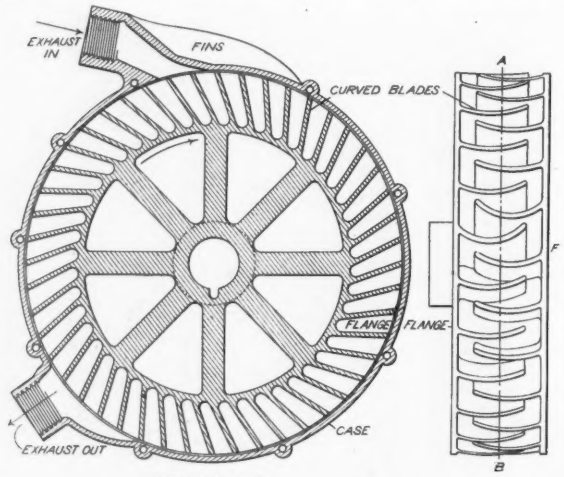



FIG. 4. SECTIONAL VIEWS OF TURBINE WHEEL SHOWING BLADE CONSTRUCTION

by casting fins on the case at this point or by the reaction blades in the case at this point such as have been applied in some of the engines built.

As the turbine usually forms the flywheel of the engine also, particularly in multiple cylinder engines, it can be made lighter than the common flywheel as the torque exerted at its periphery makes up for the dead weight commonly required.* It might happen therefore with an automobile engine that by using an aluminum alloy for the case both flywheel and case would weigh less than the ordinary flywheel alone.

On the engine as shown in Fig. 2 the peripheral chambers on the flywheel are cast on the rim, making a very inexpensive construction, but the turbines used on the engines of the type shown in Figs. 1 and 3 are made with the curved blades forming the walls of the chambers so that they may be detached. These blades have their bases resting on the bottom of the channel in the rim of the wheel, and on the flanges forming the sides of the channel.

The wheel has a clearance of 1-16 in. on all sides, and it is found that no serious leakage occurs owing to the wide flange. As there are a large number of blades on the rim of the wheel, even though the impact of the exhaust on each is not very heavy yet with the leakage over that of the cranks on the engine shaft the total power of the engine is increased. At each exhaust, it may happen that as many as 30 or more blows are struck on the blades in the rim of the wheel before the gases finally issue from the case in an almost constant stream fully expanded, and therefore without noise.

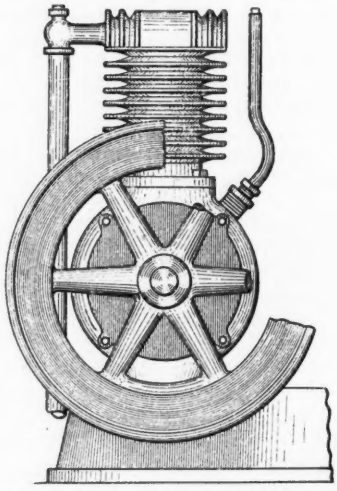
With no additional expense for fuel, or complications that require lubrication, or that can wear out, comparative absence of heat, noise, and vibration, and occupying practically the same space as the flywheel of the engines as heretofore built, the methods described in this article indicate a decided step forward in gas engine construction.

*It is a little difficult to see how a pull on the rim of the wheel can take the place of weight in flywheel action.—Editors.

## COOLING ARRANGEMENT FOR GASOLINE ENGINE

A CORRESPONDENT to Gas Review describes the manner in which he cools his small gasoline engine which is a new idea.

The pipe shown at the right is screwed into the crank case and has a longitudinal slot, 2 in. long cut in the upper part facing the cooling ribs. The upper end of the pipe is fitted with a brass plug. The slot directs the gusts of air caused by the descending piston's compressing the air in the crank case against the cooling ribs. He states that he has speeded the engine, running for 10 min. at a time at 1,700 r.p.m.



ARRANGEMENT FOR COOLING GASOLINE ENGINE

and there was no sign of overheating, although the weather was warm and no cooling device other than the one shown was used.

Of course, this cooler would not be used on a 2-cycle engine as its crank case compression is already utilized, but for a 4-cycle air-cooled engine it would give a valuable assistance to, if not entirely replace the usual fan.

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IN THE ANNUAL REPORT of the American Telephone & Telegraph Co. it is interesting to note that there are now 5,000,000 telephone stations on the Bell system, located in 50,000 cities. The report also calls attention to the new night letter service, which permits the sending of a letter of 50 words at night for delivery in the morning at the same price that a day message of 10 words is sent. Also the message may be sent in to a telegraph station over the telephone system and charged on the subscriber's monthly telephone bill.

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IF A MAN'S treatment of those he employs could be taken into consideration as a basis of credit it would become a wonderful harmonizer for labor difficulties.

# THE SCAPEGOAT IN THE GAS PRODUCER*

## HOW IT HAS EARNED ITS NAME

By F. P. Peterson

WE HAVE come, quite justifiably, to fear backfiring in the gas engine as one of its most malignant ills. Rightfully, it might be said to be a function of engine derangement having no directly traceable responsibility resting on the gas producer; and, just as rightfully, I expect to show that the gas producer must be made to bear its considerable share in the establishment of the first causes involving the evil.

### Causes of Backfiring

In their order of presentation these 4 details are the prime and sole contributors of the derangement:

First, pockets and projections existing in the combustion chamber.

Second, lean or excessively rich mixtures of air and fuel.

Third, deranged ignition.

Fourth, use of excessive amount of lubricant, or lubricant of poor grade.

Of these, the first, the third and the fourth will be seen to lay no claim whatever to connection with the producer, while the second may have connection directly or through one or all of the others, or through the method of governing, with the gas producer in measure varying as the regularity in the ability of the producer to deliver a gas fairly constant in quality. Correct any one or all of these evils, as found to exist, and you have eliminated the reasonable probability of any backfiring or prematuring in the engine operating on producer gas, assuming, of course, that the compression is as it consistently should be.

### Remedies Proposed

Around the existence of this backfiring ill have gathered a multitude of cures, chief among which has been prescribed the regulation or the removal of hydrogen as a constituent of producer gas. The reason for this seems obscure when we seek to connect it with any rational evidences visible in the operation of an engine. The offspring, nevertheless, of these suggestions has come to the surface in the form of the supposed necessity for the control and definite measurement of the ratio between steam and air in the draft supporting producer combustion.

Without in any measure desiring to criticize the several methods and appliances, many of them ingenious and unique in form, designed for the purpose of effecting the automatic control of a proper proportion of steam to be admitted along with the air for combustion in producers, it may be said that the greatest number of these fail of their purpose in practical application. Primarily, they are all more or less delicate in structure and in the knife-edge principles upon which they depend for their action.

I have been compelled to give to this persistent evil much of the time that I have tried to devote to the intelligent study of producer effects, always with the resulting conviction that in it lies the chief source of weakness from which in practical evidence the producer must suffer most.

### Hydrogen and Carbon Dioxide

The theory that excess steam in producer draft tends to the production of high percentages of hydrogen leads to the next step, which is to conclude that excessive carbon dioxide will be found in company with any considerable preponderance of hydrogen. This conclusion is borne out by the fact, and our hydrogen factor is condemned for the company in which it is found.

There exists, of course, while not clearly defined, a ratio of decrease of producer efficiency with increase of $CO_2$ in the gas produced within certain limits of extent, beyond which the condition becomes chaotic and we do not care to consider it within the practical field of commercial usage.

In following up this conclusion I have been able in some measure to determine limits within which an engine may be expected to render service and suffer dilution of the fuel with $CO_2$. And since this factor is a very dependable index to the quality of gas prevailing under any and all conditions of service and of the condition of the producer fire itself, it will become invaluable as a means of maintaining a check on and a record of operation.

The simple means required for measurement of this carbon dioxide constituent in producer gas places its attainment within the reach of every owner of a producer and of every operating engineer who cares to take the little trouble and expense of providing himself with the necessary equipment, for which the reward will be a definite knowledge of the critical limits to which his gas may vary without involving certain derangements which are sure to follow in his engine, chief among which is backfiring, due to dilution of the mixture to a degree so retarding combustion as to hold flame in the cylinder from cycle to cycle.

The recording type gage now employed in the operation of steam boilers is ideal for the purpose and may be expected to become a part of every extensive producer installation with most beneficial results.

### Permissible $CO_2$

Carbon dioxide is present in all fixed fuel gases, natural gas excepted, and in producer gas it may prevail between the limits of 2.5 and 12 per cent, permissible in engine operation.

The extent of its presence will depend jointly upon the care with which the producer is worked out in general design and the character of fuel used, and the details contributing most readily to its production are: First and most frequently, insufficient area of fuel in action against the volume of gas demanded; second, insufficient steam in the draft; third, improper relation of areas for conducting the draft and steam into the fuel bed and the gas from it, and finally, slovenly or neglectful methods of handling the producer, and, sometimes, a lack of knowledge of when to let it alone.

*Abstract of paper read at the annual meeting of the National Gas and Gasoline Trades Association.

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"No man can be great, or successful, or even tolerably decent unless he sleeps enough and with regularity." This is the text of an article on The Importance of Sleep by William Hemmingway in Harper's Weekly for Mar. 12 and it sounds a warning much needed in our day. It shows too that it is entirely possible to get 8 hr. refreshing sleep even with the noise and rush of the city around us, and points a way to personal reform for those not now doing so.

# HOW THE NEW CHIEF MADE GOOD

## HE ADVANCES HIS OLD PLANS AND GETS A NEW GERM

By Geo. H. Wallace

IT WAS with a happy heart and a light step that George Willard walked quickly up Main Street that evening to fulfil his engagement with the manager of the firm of Baum & Gautelbeim. Somehow he felt that he had at last reached the summit after weeks and months of hard work climbing the grade. So busy was he with his thoughts that he almost forgot the nature of his errand and his destination until aroused by a flood of melody that compelled him to stop. As he listened he caught the familiar music of that good old song that will always be new, sung with real feeling as well as great ability:

"And for bonnie Annie Laurie
I'd lay me doun and dee."

Naturally the eyes caught the source of what the ear had heard and he was delighted to behold through the large low window the daughter of John Gautelbeim seated at the piano and thrilling every listener with the beauty of her song.

Willard ran up the broad steps and rang the bell.

"What name please?" from the servant who answered the call.

"Oh—ah—er—Willard," said that individual, much confused.

"Did you wish to see Mr. Gautelbeim or—ah—Miss Dorothy?"

"Well—er—Mr. Gautelbeim—first." And he was ushered into the library, where he found his employer busy with the evening paper.

The greeting was exceedingly cordial, more so than might have been expected, inasmuch as there had, from time to time, been considerable friction between the 2 men. They chatted very pleasantly on current events until dinner was announced, when Willard was reduced to utter forgetfulness of everything else on being presented to Miss Dorothy.

Later they returned to the library, where over their cigars they became chummy. "Willard," said John, as he settled himself comfortably in his chair and blew a cloud of smoke to the ceiling, "Willard, why is it that every time you and I 'smoke up' you always seem to gain your point; why is it?"

"Why? Well, I don't know! I don't know that I do always win my point, but as a usual thing you most always lose yours," replied the chief, laughing.

"Well, why is that?" asked John with a smile.

"Did you ever stop to think, Mr. Gautelbeim, that when one loses his temper it makes a breach in his defense that weakens any good arguments that he may have which would otherwise be most convincing; and absolutely prevents one using his reasoning power?"

Gautelbeim swung around, threw one knee over the other, hooked one arm over the back of his chair and clasped his hands.

"Well, I don't know but what you are right. I never had it put to me just in that way before. Yes, I can see why you are right. But why have I always convinced others, previous to—to—to—your association with our firm?"

"You didn't convince them. They simply shut up because they were afraid to talk back," said Willard.

Gautelbeim smoked vigorously for a few moments, then said: "Why is it that you are not afraid of me?"

"Well, I don't see anything to be afraid of, do you?"

"You speak quite plain, don't you?"—somewhat nettled.

"You asked me a plain question and I answered it as I thought; not as I thought you would like to hear it. It hurts sometimes to have the fur rubbed the wrong way. But why all these questions on an unpleasant subject?"

"Well," said Gautelbeim, "I've sort of come to the conclusion that the cause of not only my own hardships but those of the firm as well, have been caused by something I've done or said and I can't get anyone who will come right out and tell me above board what he thinks; not till I've met you. Now you are a fighter—not a scrapper—but a fighter, and I invited you up here tonight to get pointers, not only on—er—what we have been discussing but about the power house. I don't know a thing about this modern business. I thought I was doing the right thing when I bought those old engines and boilers cheap and set them where they are. I really did. I've done a lot of darn fool things in my day and I'm sorry that somebody didn't call a halt.

"There's that little gas engine deal with Redfield that cost us over $800,000, and what have we got to show for it? Nothing but that old rattletrap gas engine running over there in the works. To make good the losses of this and other similar ventures I had to cut wages. Wages are always the first and last thing to suffer. If we lose a large sum of money through poor investment or through the failure of some of our dealers or agencies, we have got to get even some place.

"Good men won't work for small wages under ordinary circumstances; they don't have it. We had to use what would work for the wages we offered. What was the result? The quality of our output ran down till it was practically culls. Yes culls. Take for instance—well—some of those wagons that came back from Oklahoma and which are stored in that shed back of Building "E." The hounds are checked, the pole is cracked, the axle sprung, the box checked and some of the ironing burned in working. I noticed one wheel on which the tire was so large that I ran my knife between the tire and the felloe. Why? Because we had men—then—to whom a pole was a pole, an axle was an axle, and a board a board. Everything went, as long as it looked something like what the boss told them to get out. They didn't know how to select, or what to select or what to throw out. Everything went—including profit.

"Now Mr. Willard, I needn't go on like this any longer. You know as well as I, for you have been around the plant as much as I and are shrewd enough to keep your eyes open—and your mouth shut. There was a time when a man was a man, to me; just so much animated clay—all the same, except myself. You opposed me the first time we met. Not exactly opposed me, but rather you did not come readily under my will and subject yourself to my ways. You had ideas of your own. You had individuality. I've treated you almighty mean, Mr. Willard; almighty mean, and I want to say right now that I'm sorry I did these things, and there's my hand on it."

Gautelbeim thrust out his massive fist and it was eagerly grasped by the chief engineer. Neither spoke. They simply looked into each other's eyes and mutually understood each other. It was one of those occasions that come into every man's life more times than he imagines, when the spoken word is useless. As they settled back into their chairs, Mr. Gautelbeim said:

"Now, Mr. Willard, what do you want to do. I am no mechanic but I have confidence in you. I believe that what you do, you try to do for the best interests of the firm. Now what do you want to do?" And John lit a fresh cigar.

"I want to concentrate the entire power equipment in one large modern power house conveniently located, down along the river where we can get our coal by boat, hoist in into storage bins overhead by machinery, and let it run by gravity to the boilers, being weighed en route. I propose to install automatic stokers and use a grade of coal that will give the best service for the dollar. I want to install, as I told you this afternoon at your office, a modern engine room where we can produce light and power for just about one-half what it costs now.

"First of all I want to start on the boiler house and the tunnel. We are jogging along now on from 75 to 90 lb. of steam all over in all of our 7 engines. I want to get the boiler room equipped with modern high pressure boilers good for 160 to 175 lb. of steam. But for a little while I will carry only 120 lb. or so. That's about all those old engines will stand. I will cut out all old boilers and throw them in the scrap, and run a temporary steam main to these old engines by means of the tunnel.

"You will observe that very little of this tunnel is 'outdoors,' so to speak; most of it is included in the basement arrangement of the different buildings. This will distribute the steam to the various buildings for heating in the fan blast system of the new factories at a minimum of cost and provide natural drainage for the return back to basement of engine room. Air and water pipes and sewage (under floor of tunnel) and wiring for power, light, signal and phone service can be installed cheaply, and in case of fire the loss will only be what is above the ground floor.

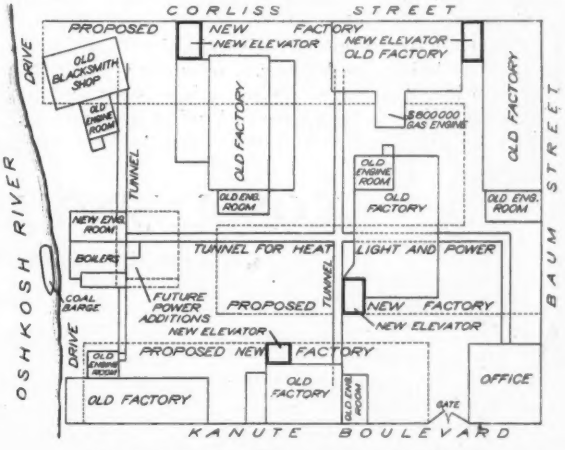
"On this general drawing or plan of the plant is shown the distribution of the old factories in heavy lines and the proposed factory of Supt. Mather, which will be erected so far as possible over the old buildings and then the latter torn down. Here are several old engine rooms, including the gas engine and the 4 new elevators which Mather installed to expedite the rapid production of goods in the old works and which will be conveniently located in the new factories. The engines will simply be reducing valves between the boilers and the heating systems. This can all be done the coming summer and by October—say, or earlier,—we will be in shape to start in another winter.

"In the meantime I want to contract for the engines, air compressors, etc., as required, and install them in the new engine room, transmitting the current by means of the tunnel to all departments of the works as required.

"Another thing I want to do, and in which I have the hearty approval of Superintendent Mather, and that is, to select a standard type of motor and stick to it. I don't want a sample of every motor on earth; just one make. And the number of different sizes will be small; probably not over 5 or 6 different sizes, and if a motor becomes defective a servicable motor can be put in place of it in not over 15 min. when the defective one can be thoroughly repaired, tested and kept on hand for another emergency. It does not take long for a hundred men standing idle for lack of power to run up into money.

"For instance, over in the machine shop in Building "B" are—say—100 men; there are more we know. They average about 30 cents an hour each. That is a total of $30 an hour for the shop. Suppose that an armature burns out a coil, or any other of the thousand and one little troubles happen, and shut down for a half hour, say. There's $15 loss right there. At 6 per cent that pays the interest on $250 for a year—just that one-half hour shut down. It isn't the material entering into any commodity that makes the cost, but the time consumed (and unconsumed) in its manufacture as well, and time money is as valuable as material money every day in the year.

"At such times of the year as we shall not require steam for heating the engines will run condensing.




THE OLD AND PROPOSED FACTORY LAYOUT

They will all be double eccentric and easily adapted to either service. As soon as we get one engine in serviceable condition we will cut out the old engines and scrap them and handle their load by motors from the main power house, and gradually the entire works will be modernized without seriously interfering with the operation of the plant, if at all."

"Mr. Willard, you seem to be perfectly familiar with manufacturing costs and things with which the average engineer is not familiar. How did you learn it?"

"Well," said Willard, modestly, "I don't think that it takes much of an engineer to equal and surpass me, but what little I do know, I got by beginning on the back end of a No. 6 scoop shovel, and making a study of the business,—nay, art, for modern power plant engineering is an art, a science. I never was content to stay at the bottom; I always wanted a better job than the one I had, and always got it. But I'll tell you candidly, Mr. Gautelbeim, that when I first took charge here I felt that somehow or other I had slipped a cog and gone backwards. Mr. Mather, with whom I have been acquainted for a number of years, wrote me very enthusiastically about the position and dwelt particularly on the future and held up the argument that it was an opportunity of a life time.

"I made inquiries regarding the power equipment, but he was so reticent on that subject that I was completely in the dark. When I arrived on the job and saw those old engines that never were any good even

when new, and those old boilers that were straining at every rivet and leaking at every joint, my heart almost failed me. For the first time in my life I was face to face with failure. I was disheartened. Then I concluded that whoever was foolish enough to run that kind of a plant needed a guardian, and I decided to hold the job and succeed or bust.

"I formed my impression of you from your equipment the same as you can judge a man's character by his shoes or his handwriting, and it is seldom that I find it necessary to change my first impressions."

"Mr. Willard, you don't know how refreshing it seems to have some one talk right off the bat and not fawn and cringe around my feet like a cowardly convict pleading for his life. I don't like open rebellion, just for the sake of strife, but I do like to see a man stand right up above board and say his say and fight it out in the open."

The conversation was continued along the line of approximate cost, economy, durability, and upon the details of the plant, future extensions, etc. Finally, Mr. Gautelbeim asked:

"When do you intend to advertise for bids for the engines and boilers and other machinery?"

"There is not going to be any advertising for bids. This is not going to be a case of buying groceries and supplies for the alms house and insane asylum where the lowest bidder gets the contract, let the quality be what it may; there will be no advertising. Just as soon as we can arrive at something definite as to what me must have, then we will ask for prices on our specifications from those engine builders that we select as making a machine such as we need and want."

Having threshed the subject over pretty thoroughly, the manager arose and looked out of the window into the darkness. Then he suggested that they repair to the music room. "My daughter will play for us," and as they left the library John was a changed man. No longer that bullying, domineering way that had made him not only known but feared by all with whom he came in contact; now his face looked clean, and bright and frank, the face of a square, openhearted man.

As Willard strode down the street that evening he literally walked on air. Not only had he come to an understanding with Mr. Gautelbeim, but that formerly crusty gentleman had kindly extended to him the hospitality of his home. The stars twinkled merrily overhead, and they seemed to wish him success and say to him, "Your opportunity came and you grasped it." But above all other things in his mind there ran those old familiar words as sung by Miss Dorothy—

"And for bonnie Annie Laurie,
I'd lay me doun and dee."

# CONDENSING STEAM WITH AIR

## SOME PROPERTIES OF AIR AND THEIR USE

BY ARTHUR PENNELL

ABSOLUTELY dry air does not exist in nature. The atmosphere at all times and places carries, mechanically mixed with it, some amount of water vapor.

The amount of water vapor that air can absorb depends upon the temperature. A cubic foot of completely saturated air consists of a cubic foot of water vapor at the elasticity due to the temperature and a cubic foot of dry air at the elasticity of the difference between the barometric pressure and the elasticity of the water vapor. The 2 commingled form 1 cubic foot of saturated air at the barometric pressure.

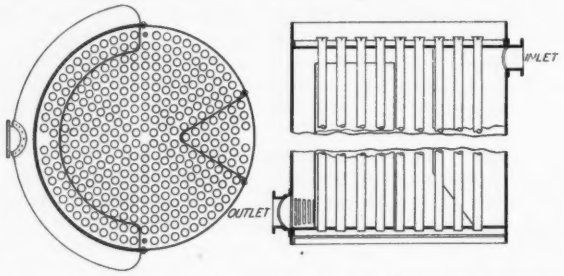



FIG. 1. HORIZONTAL AND VERTICAL SECTIONS OF ATMOSPHERIC CONDENSER

As an illustration: On a foggy morning the air is so completely saturated that small visible drops of liquid water are floating in it. Subsequently, as soon as the heat from the sun is available, the fog dissipates by reason of the visible liquid vaporizing into the air as fast as sufficient heat is obtained from the sun's rays.

Everybody must have undergone the experience of having, when in a profuse perspiration, suddenly encountered a draught of air. A chilly sensation ensued, due to the vaporization of some of the perspiration into the air at the expense of the heat of the body.

These 2 examples from common personal experience exhibit the property that air possesses of causing water to vaporize into it at the elasticity due to the temperature whenever available heat for the purpose is present.

Properties of air have been exhaustively investigated by many eminent meteorologists, who have devised formulas and extended tables from which the amount of water vapor present in the air under any atmospheric conditions can be obsolutely determined.

By utilizing the foregoing properties of the ever-present atmosphere, a current of air can be used to carry off the latent heat evolved by condensing steam and dissipate it into the atmosphere.

### A Circular Form of Condenser

Figure 1 shows a sectional elevation of 2 surface condensers, using air as a cooling agent, which were erected in 1898 on the premises of the Armour Packing Co., of Kansas City, Mo., by the Atmospheric Condensation Co. They had shells in which, between tube-plates, 326 ordinary 4-in. boiler tubes were inserted; steam enters at the side from the distributor and, by means of suitable baffle plates, is caused to circulate among the tubes, condensing as it goes, until the noncondensable gases which are present reach the outlet and pass on to the vacuum pump. Condensed water collects on the lower tube plate, and, through a pipe connecting with the pipe from above at a lower level, flows to the vacuum pump.

At the upper end the tubes protrude 4 in. beyond the upper tube plate, the ends having been, previous to the insertion, crosscut twice to a depth of 0.75 in., and 1 edge of each cut bent back so as to form 4 Vs in each tube. The condenser is mounted on 6 cast-

iron suports, which stand on the curb wall of a circular cistern. The shell is continued upward, in light sheet-steel, forming a flue 50 ft. high.

A centrifugal pump takes water from the cistern and delivers it, through a system of distributing pipes, upon the 5 blank spaces at the center and 4 cardinal points in the outer ring of tubes. The water rises at the tube-plate to the apex of the Vs, where it enters the tubes at the sides in vertical sheets and spreads over the internal surface, in which process it is assisted by the upward current of air which starts as soon as the tubes warm up.

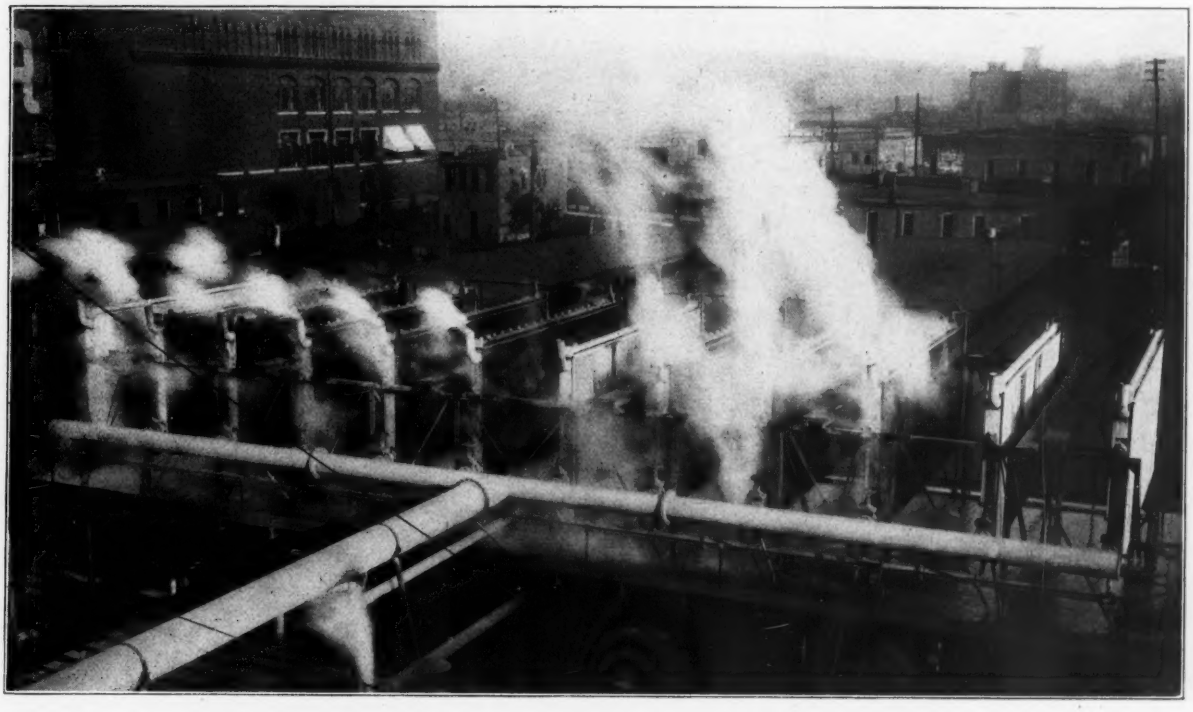


FIG. 2—ATMOSPHERIC STEAM CONDENSER AT ARMOUR PACKING CO.'S PLANT

One of these 2 condensers received steam from a 30 and 58 by 48-in. compound engine, and the other from a number of simple engines, discharging at atmospheric pressure.

After 10 yr. of service, the lower tube plate in one of the condensers, which was made of 0.5-in. plate, became so corroded that the tubes could no longer be expanded to remedy leakage; ten yr. of service, 24 hr. a day and 7 days a week was considered to have earned the apparatus a release from duty, and a new one was installed, as shown in Fig. 2. This is of the plate section, form with a surface of 3840 sq. ft. in 12 units of 320 sq. ft. each. The guaranteed duty is ability to condense sufficient steam in 24 hr. to make 350 tons of ice, the escaping gases issuing at 150 deg. F. or over for the best results.

### Operation

Exhaust steam in the shell or inside the plates heats the surfaces over which the water is trickling, and thus the film of water; this film evaporates at the expense of the latent heat of the steam, into the air, and the current of heated air which starts as soon as the surfaces become warm, carries away the vapor thus removing the heat from the condenser. It is found that about 2 lb. of cooling water are required to condense 1 lb. of steam, thus making a considerable saving in the expense of water needed and in the power required for handling it.

## GOOD RULES FOR THE ENGINE ROOM

ALTHOUGH these are part of a set prepared for the guidance of the men in the shop of the H. Mueller Mfg. Co., they are equally applicable to the use of tools in the engine room, and are worth getting firmly in mind.

Rule 1. A file must not be used as a hammer, chisel or pry.

Rule 2. Do not use a monkey wrench as a hammer.

Rule 3. A wrench used on the head of a bolt or screw, or on a nut, should fit closely; otherwise it will gradually round the corners.

Rule 4. Never use a large wrench on a small bolt, screw or tap, without considering the amount of strain that the bolt, screw or tap will stand.

Rule 5. All working parts of tools should be kept well oiled. The shanks of tools should also be oiled slightly and wiped to keep them from rusting.

FOR MAKING A SOLDER repair job, the best solder is made from 1 part tin to 1.5 parts lead. If this is not available, common solder will do. Use tallow or resin as a flux and cover the parts where the solder is not to stick with a mixture of lampblack and size. Be sure that the parts to be soldered are heated before the solder is poured on as the solder will not stick otherwise.

THE OBJECT OF A FLY WHEEL is to compensate for the irregular turning movement which will occur in ordinary working, and to prevent the consequent variation of speed from exceeding certain predetermined limits. The energy shown in a fly wheel varies as the square of the velocity, and directly at the weight.

# TROUBLE WITH DENSE AIR ICE MACHINES

## SUGGESTIONS HOW TO OVERCOME THEM

By M. Strzyczkowski

IN READING the papers, one will find little in regard to the handling of the dense air ice machine, and how to overcome the difficulties encountered.

In my first days when I had the theory but little experience, I often ran against trouble that kept me guessing for days, and I would have been more than glad to find something on the subject. Now, having some experience, I am glad to put it at the service of others.

### Losing Pressure

At one time, the machine began losing pressure until it had dropped down to 60 lb. and only after a long hunt I found that a coil had carried away. We took out the coil, and sent it to the shop, and while it was being repaired I fixed up the machine, keying up a rocker, which was loose, about 1/16 in. and then decided to make a new joint on the ice box.

After we took the ice box apart, I discovered that we had no gasket large enough to make the joint, so I had to let this go disconnected until I could get a gasket large enough to make the joint. By that time the coil was fixed and we put the machine together.

I shut off all the system and started the machine on short circuit, and after running 2 or 3 hr., I couldn't get the pressure higher than 45 lb. while 225 lb. was required. I thought that the coil was still leaking and tested it but found it all right. I examined all the joints and the air pump stuffing boxes, but could find no leak so came to think there must be something wrong with the compressor valves, because I had keyed up the rocker arm.

Before the coil gave way the man on watch by mistake filled the lubricator with linseed oil, and, as I thought that this might have injured the valves, I took them apart and found them in very bad shape.

After facing off the valves and scraping the seats, I put the machine together and started up. I was more than disgusted; the same thing again; only 45 lb. and I didn't know what to do. In order to test the compressor, I closed the valve of the expander inlet pipe so that the air could not go to the expander and the pipes. The compressor gage began to register higher and in about 5 min. was up to 230 lb. showing that there was no trouble with the compressor and air pump.

I then opened the valve to the expander again and continued to run the machine, but as soon as I opened the valve, the pressure began to drop, and in about 10 min. was down to 45 lb. again. Then I knew she was leaking somewhere, but where was a question.

As I could find no leak on the machine, I concluded that the air must escape from the system in some mysterious way and started a hunt. Without hesitation, I went to the ice box and found that air was coming from the machine. Of course air could escape from the machine only by the main air pipe to the system, hence the valve on the main pipe leading from the machine to the system had been leaking. Here was ali the trouble for as the ice box was disconnected, all the air had been escaping to the atmosphere.

This accident taught me a good lesson which was of great value, and it can't keep me guessing any more.

### Another Case of Lost Pressure

When pressure begins dropping, naturally every engineer will shut off the system and run on short circuit to see whether the leak is in the system or in the machine. Before that, not knowing that the leak was in the valve, I was in difficulty to locate it. One time the pressure dropped to 180 lb. and I put the machine on short circuit, but, of course, not knowing that there was a leak to the system, I used to blame the machine.

I was looking all over the machine and couldn't find anything wrong. It kept me guessing for a few days, but I finally found the leak in the refrigerator. It fooled me several times like that and I finally tried to get some way to locate the trouble. I did it to a certain extent.

### A Method for Locating Trouble

When the machine doesn't maintain pressure, and you come to the conclusion that the leak is in the machine, still you don't know where it is, and if you try one thing after another it takes time as well as patience. You have to know that the coil is right as well as the air pump.

To test the coil I place an ordinary water gage on the overboard discharge pipe for circulating water, then stop the machine. If the leakage is in the coil, the air will pass up through the water glass. If no air passes up through the glass, the coil is all right.

To test the air pump, I placed a valve on the pipe from the air pump to the moisture trap; by closing this valve, the pump will discharge the air to the atmosphere through the safety valve and you can see whether the pump is working right or not. If it doesn't work, take it down, and you can see what is the matter without losing pressure on the machine. Without this valve you have to stop the machine and you will lose all the air which will set you back for 2 or 3 hr.

### Tracing a Leak in the System

When the pressure isn't maintained, shut off the system and run the machine on short circuit to be sure that there is no leak in the main valves to the system. To test these, let all the air out of the system, put the machine on short circuit and open the drain cock on the ice box or in the refrigeration. If air comes out, it indicates a leak in the main stop valve.

If the machine and stop valves show up all right, put the air on the ice box, and if the pressure keeps dropping, there is the leak. Examine all the joints by painting them with soap water or put your ear to the joints and you can often hear the air hiss through; or take a candle and go over the joints to find where the air will blow the flame; one of these methods will locate the leak.

If the machine will still maintain the pressure when the ice box is on, put the air on the refrigeration and then on the drinking water butt, trying each system separately by the same method. But if the machine will not hold up pressure when run on short circuit, go over the joints by the methods already mentioned, and the stuffing boxes by dropping oil on the rods. The air will blow the oil so that it will bubble. Any leaky joint should, of course, be tightened or repacked.

Another way to test the machine is to disconnect the circulating water discharge pipe, and, if the air bubbles up, it indicates a leak. To test the compressor, close the valve of the expander inlet pipe and run the

machine. The pressure should go up immediately, if the coil is all right. If not, it indicates that the compressor is out of order.

### Choking Up

There may be trouble not only from leaks, but if the trap or any portion of the run of the pipes is allowed to be choked with frozen oil or snow, or by closing of the valves, the relation of the pressures will be changed. If you can't find the leak at once, don't blame it to the cup leathers. I know one engineer who changed his leathers twice in 24 hr. because he couldn't find a leak. The builders claim that a set of leathers will last 1 to 2 mo., and we have run the same leathers for the last 5 mo., though we have been for the last 3 mo. running only 14 hr. a day.

It is recommended that once or twice a day the machine be cleaned by heating and blowing out all the oil. I have found it unnecessary to blow out so often, if you do not give the machine too much oil. Blowing once or twice a day means a loss of 2 or 3 hr. and we get better results by blowing every second or third day, but be sure that there is no oil or water in the machine because that will disturb the freezing. Also be sure that the machine has enough supply of water.

Last year at this time we used to run the machine day and night for the same requirements of ice and cooling surface as now; once or twice we shut down for a day or 2. Now we run only 12 hr. a day which means less fuel, less oil, less calcium and less labor. Of course it is not on account of blowing the machine less often, but because of the care that is exercised to get the best results from the machine on the smallest expense. If you have any trouble with your machine, follow the suggestions given and I am sure that you will save a lot of time and labor.

## ENGINE ROOM JINGLES

By F. Caldwell

"SHORTY" was the only name I knew him by. He came from a small town in California, where he had served his time, building vises, bicycles and safety pins. His experience at that class of work must have satisfied the recruiting officer as to his ability as a machinist. He was only in the "Outfit" (U. S. Navy) a few days, when he was drafted aboard the transport Solace, with 300 men, mostly "Rookies" (recruits), bound for the fleet in Asiatic waters. Shorty was transferred to our ship, U. S. S. Wisconsin one afternoon, and next morning we pulled up the "mud-hook," and streamed out of Yokohama in the wake of the Flagship, for Honolulu.

He was detailed to my watch in the port engine room, in charge of the auxiliaries. After he got his "bearings," he came over to me while I was busy figuring the revolutions per minute for the last hour.

"What is that bent glass tube for with the water in it on the 'wall' (bulk-head) there?"

Glancing over my shoulder at him I saw that he referred to the draft gage.

"That bent glass tube, Shorty, shows me how much water is in all the boilers, and if it should show empty on this watch while the boilers are steaming—well—Shorty, it will be a long swim from here to Honolulu for the ship's crew." He seemed greatly impressed with the knowledge he had gained about one of the appurtenances of the boiler room.

About half an hour afterwards I saw Shorty beat it up the ladder as fast as he could go and return in a few moments with the Chief. Going over to the Warrant Machinist, he held a spirited conversation with him while Shorty stood close by. That finished, he came over alone to where I was standing at the throttle and said: "I want you to thoroughly understand that this isn't the time or place to play your practical jokes, and the next time anyone of the men on your watch asks you a question, appertaining to the gear of this engine room, you are to answer truthfully, or I will put you on report."

With that parting shot, he left me standing dead on the center. I cudgeled my brains to find what the call down was for, when the Warrant Machinist came over to me and said:

"Say, Scottie, why did you empty that gage?"

I jumped over to the bulk-head and looked at the draft gage. Sure enough, it was empty.

I found out afterwards that the oiler overheard the conversation between Shorty and me, and thinking that he would give him a scare, he had removed the gage and emptied it, unbeknown to me.

No doubt Shorty knows now that in most naval vessels the closed fireroom system of forced draft is extensively used. All openings from the fireroom are closed air-tight, and air forced in, until the desired pressure has been reached on the draft gage.

The gage may be placed anywhere convenient, provided it is connected to the compartment under pressure.

## TURBINES AND EXHAUST HEATING

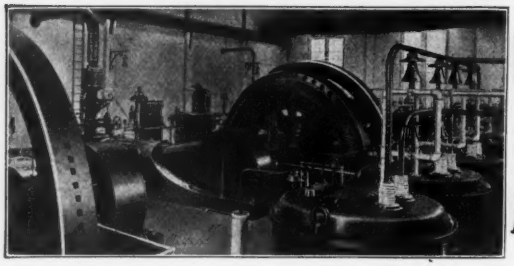
MANAGEMENT of the Pennsylvania lines west of Pittsburg has placed an order with Allis-Chalmers Co. for electric generating units to increase the capacity of the power plant at Conway, Pa., from which current for operating the shops there, and also for railway signal work, is supplied. The new machinery consists of 2 750 k.v.a., 3,600 r.p.m., 60-cycle, 3-phase, 2,300-volt steam turbo units. The turbines will receive steam at 145 lb. pressure and 100 deg. superheat. During warm weather the turbines will exhaust into a condenser in which a 28-in. vacuum is maintained. During cold weather, steam from the turbines will be used in heating the plant, and a maximum back pressure of about 2 lb. will be effective on the exhaust end. By operating condensing in summer and using the steam for heating in winter, the greatest economy of coal consumption is obtained.

For exciting the alternators, 2 units are to be supplied. One is a 25-kw., 120-volt, 260-r.p.m. direct-current generator coupled to an engine. The other is a 25-kw., 125-volt generator direct connected to a 3-phase, 60-cycle, 2,300-volt, 900-r.p.m. synchronous motor. This motor is rated at 150 k.v.a. and, besides driving the exciter unit, will serve as an electrical condenser and thus improve the power factor of the station.

Two 12-kw. flywheel type motor-generator sets will be installed in the station for supplying current for the railway signal system. Each of these will consist of a 12-kw., 600-volt shunt wound generator direct coupled to a 220-volt, 1,720-r.p.m. induction motor.

ELECTRICAL OPERATION of the Pennsylvania local lines near New York in New Jersey and Long Island has shown, according to the figures of George Gibbs, chief engineer, a reduction in cost to 17.8 cents per car-mile, as against 27.95 cents for steam operation on the Long Island lines, and to 20.46 cents from 22.3 cents on the West Jersey lines.

# ELECTRICAL MACHINERY AND APPARATUS



## BALANCING THREE-WIRE, DIRECT-CURRENT SYSTEMS

### SOME OF THE METHODS USED

By W. G. Hamilton

ADVANTAGES of the 3-wire direct-current system are well known, the chief one being the saving in wire and transmission loss. The chief disadvantage is the need of providing means to take care of the unbalanced load which occurs to a greater or less degree at all times. With the system perfectly balanced, the entire power is transmitted by the 2 outside wires, the neutral wire coming into use only in helping to balance the load. This condition of exact balance is rarely met and some provision must be made at the station to take care of the unbalancing of the load.

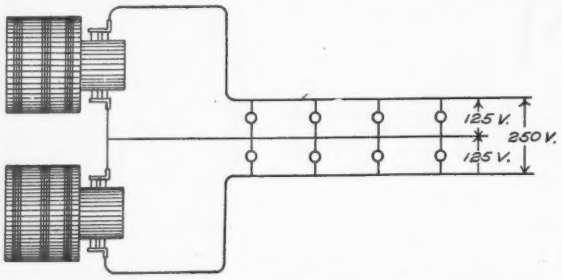



FIG. 1. CONNECTION OF 2-GENERATOR SYSTEM FOR 3-WIRE MAINS

One of the first methods used was to place a bank of lamps or other adjustable load at the station and by this means the attendant kept the load balanced, thus keeping the voltage balanced. This was a crude method as it required constant attention and used power to balance the system which was so much dead loss.

#### Two-Generator Method

Another method is to use 2 generators connected in series, feeding to the 2 outside wires, and bringing the neutral wire to the common terminal of the 2 generators. When the system becomes unbalanced, the extra current is carried by the neutral wire and is furnished by 1 of the generators which is on the unbalanced side of the system. Balanced voltage is thus maintained by the regulation of the generator fields.

The chief objection to this method is the expense of the 2 generators, both of which must be run at all loads.

#### Rotary Balance Method

A later method is to use only 1 generator supplying power to the outside mains at their voltage. The unbalanced load is then taken by small machines floated in series across the mains with the neutral wire connected to their common terminal. When the unbalanced load comes on, the voltage on the lightly loaded side rises and on the heavily loaded side drops. The machine on the light side then takes power from the line and runs as a motor driving the machine on the heavy side as a generator, supplying the extra current for that side. This action tends to bring the voltage back to normal and gives good regulation.

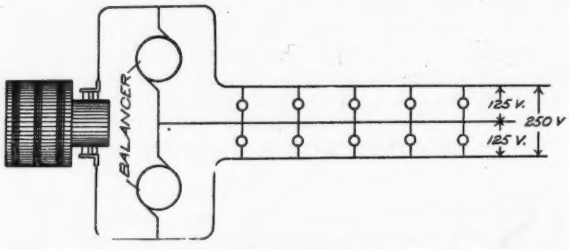



FIG. 2. ONE GENERATOR ARRANGEMENT WITH ROTARY BALANCING SET

In some cases the field of each machine is connected to the opposite side of the system which gives a quicker action. This regulation is automatic and the set takes care of unbalanced load in either direction without any adjustment.

#### Balancing Coils

Another method which does away with any additional rotating machines makes use of auto-transformers, commonly called balance coils. The regular 2-wire generator is used supplying power to the outside wires. The generator is provided with slip rings connected to the armature in the same manner as for a 2-phase rotary converter. These rings are much lighter than they would be for a converter as they carry only about ⅛ of the generator load.

These rings being light are usually placed at the end of the commutator and connected directly to the commutator bars. The balance coils themselves are built of standard transformer parts, and are placed in cases similar to those of ordinary small transformers. The coil has a straight continuous winding, both ends and 1 tap from the middle point of the winding being brought out of the case.

Two coils are used with each generator and are connected to the slip rings, 1 across each phase. The taps from the middle points of the coils are connected together and to the neutral wire of the system. On

balanced load the coils take a small alternating exciting current from the slip rings, as any transformer does when connected to an alternating-current line with its secondary open. When the unbalanced load comes on the current in the neutral divides, half going to each coil. This enters the coil at the middle point and half flows each way through the coil and through the slip rings into the armature winding. The unbalanced current is thus fed back directly into the generator armature continuously.

The balance coils are small and can be placed back of the switchboard or below the floor, as they require

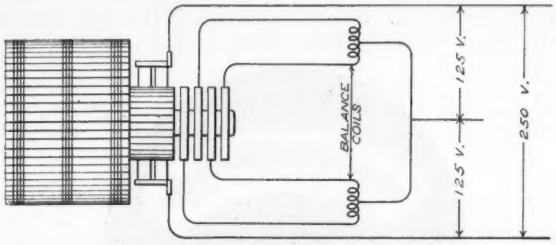



FIG. 3. CONNECTIONS OF BALANCING COIL SYSTEM

no attention. The current flowing to each slip ring is 0.25 the direct current in the neutral wire with the small exciting current taken by the coil added.

The coils are usually built to take care of current in the neutral equal to 0.25 full load current of the

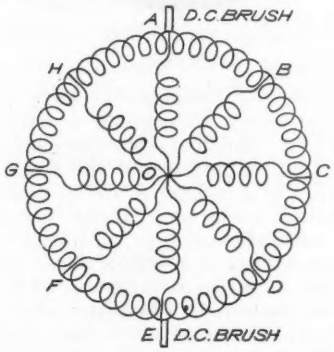



FIG. 4. DIAGRAM FOR SHOWING CORRECTNESS OF BALANCING COIL CONNECTION

generator with a voltage regulation not to exceed 2 per cent. The operation of this method depends on the following points: First, the impedance of the coils keeps the exciting current which they take from the slip rings down to a small value as it is alternating current. At the same time the current from the neutral wire flows through the 4 half coils in parallel, and being direct current is impeded only by the ohmic resistance of the coils, which is low, giving only a slight loss in the coils.

That the common point to which the neutral wire is connected is at all times neutral to the + and — direct current brushes is readily shown. Referring to Fig. 4, let AE, BF, CG and DH represent the balance coil and its connection for different positions of the armature of a bipolar machine. Let O be the tap to the middle point of the winding. Take the instant when the balance coil taps are directly under the direct current brushes as shown at position AE. It is evident that since the point O is the middle point of the coil, it is neutral between A and E. When the armature turns so that the balance coils take the position BF, the voltage drop between A and E may be divided into 4 parts, AB, BO, OF and FE. As in the first instance, O is neutral between the ends of the coil, and the voltage drop over OF equals that over OB.

Since the space AB includes the same number of armature coils as space FE and they are in fields of equal strength, the voltages across the 2 spaces will be equal, and the voltage over AB equals that over FE. Then adding equals we have; AB + BO = FE + FO and O is neutral between A and E as in the first case.

In the same way it can be shown that O is neutral between the direct current brushes for any position of the balance coil taps. One coil will operate the system, but 2 coils giving 4 points spaced 90 electrical degrees apart give better distribution of the current to the armature winding and better regulation of the voltage.

## THE HUTCHISON ELECTRICAL TACHOMETER

THIS new instrument is designed to indicate precisely the rate of rotation of any machine at one or more remote points.

The tachometers with which American engineers are most familiar use either the principle of centrifugal force or electricity in their operation. In both forms the indicator of speed bears a limited place relation to the rotating shaft, the rate of which is to be shown. That is,—the rotor is mounted in the indicating portion and is direct connected, belted or driven through some flexible coupling from the shaft, and must necessarily be located adjacent to the shaft, or at a short distance, limited by the mechanical difficulties of positively transmitting motion therefrom. An illustration of successful short transmission of rotation is the automatic speed meter.

For greater distances and for precise work recourse must however be had to other than mechanical means. To cover this broad field, beyond the reach of ordinary speed indicators is the purpose of the Hutchison Electrical Long Distance Tachometer, which is the subject of this description.

Essentially the Hutchison Tachometer may be considered as 2 parts:

(1) An alternating-current generator, or magneto, of the revolving field indicator type, driven by the shaft, the speed of which is to be measured.

(2) A voltmeter, wired up to the generator, and located at any remote point where indications of speed are desired.

The voltage of the generator is proportional to its speed, so that the voltmeter can be calibrated to read direct in r. p. m.

In practice a plurality of voltmeters or indicators, placed at widely separated points, may be operated from the same generator, so that the tachometer will indicate speeds at as many points as desired, as far away as desired, within reasonable limits. A number of operators, therefore, at widely separated points can have precise indications of speed always before them, so that intelligent, concerted action may result. The closer bond between navigator and engine room on steamships is an illustration of the service rendered by this instrument. It makes remote control of speeds precise, sure and easy.

The a. c. generator eliminates brushes and commutators and, therefore, the variable pressure and resistance between them. The makers state, in fact, that every joint in the circuit from the armature to indicators is soldered. The generator is small and compact, and the indicators built to operate on a minute current. The conductors are, therefore, small and introduce lit-

tle drop and the load on the generator, even with a plurality of indicators, is small in comparison with its capacity.

Many novel devices it is understood have been used in perfecting this instrument for practical everyday service. The evident value of such a tachometer in marine service led the inventor to develop first the marine type, which will here be described. It was first placed on a ship about 18 mo. ago, but 2 yr. have been spent perfecting details and in preparing for extensive manufacture.

The application to ship service necessitated several modifications in design, the principal ones being twin generators, so as to show direction of rotation as well as rate, inertia compensators for angular variation of

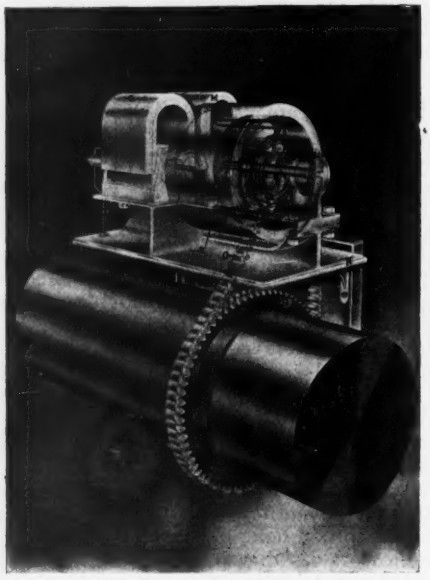


FIG. 1. HUTCHISON ELECTRICAL TACHOMETER ATTACHED TO SHAFT

speed of driving shaft; and special form of indicators. Otherwise the description of the marine type will convey a good idea of the principle and construction of this new instrument.

Referring to Fig. 1, P represents the ship shaft. Clamped around the ship shaft is the split sprocket A. Rotation is imparted to the driving sprocket B by the Morse Silent Chain C. Sprocket B is not keyed to the generator shaft D, but is simply rotatively mounted thereon. Two oppositely coiled flat spiral springs EE′ transmit the rotation of B to the flywheel F, which is keyed onto shaft D, one end of each spring being attached to the sprocket B, and the other end to the flywheel F. Any irregularity, therefore, of rotation in B, caused by variations in angular velocity of shaft P, is smoothed out by EE′, so that the rotation imparted to F and D is a constant resultant speed. The springs are protected against strain or breakage from sudden reversal of P by radial arm G, engaging pin H, attached to the flywheel.

On the inside face of the flywheel at the end opposite from that occupied by EE′, are cut gear teeth, so arranged as to engage pinions J and K, which actuate magnetos.

Pinion K is keyed to the indicator shaft of its magneto M.

Pinion J is not keyed to its shaft, but is so mounted that when the direction of rotation of the main shaft is "ahead" the inductor of magneto L is in the exact rotative relation to its armature and pole shoes as that of magneto M. The current from L is therefore in phase with that from M, but when P is reversed in rotation, pinion J rotates idly on the shaft of magneto L, until it has traveled 90 deg., at which point it begins to drive the magneto. The result is that the inductor of L assumes an exactly opposite relation to its armature and pole pieces from what obtains at the same instant in M; hence the current from L is 180 deg. elecrically out of phase with M.

Two wires run from L and 2 from M to each indicator. When running "ahead" the circuits are in phase. When P rotation "astern" 1 circuit is 180 deg. electrically out of phase with the other.

FIG. 2. INDICATOR OF HUTCHISON ELECTRICAL TACHOMETER

The indicators or voltmeters have 2 coils,—the moving coil to which the pointer is attached and a fixed or field coil. The field coil is connected electrically to one of the magnetos and the fixed coil to the other. When the 2 magnetos are in phase,—that is, when the shaft P is running "ahead" the deflection is to the right, and indicates r. p. m. "ahead."

When they are 180 deg. out of phase the pointer is deflected in the opposite direction, or to the left, indicating r. p. m. "astern." The faster shaft P turns in either direction, the higher the voltage generated and the greater the deflection of the pointer calibrated to conform thereto.

Figure 2 represents the indicator designed for pilot house use. It has no iron, steel, or other compass-deflecting materials in its construction and may, therefore, be placed in proximity to the compass without affecting it.

This type is also used in the staterooms of the captain and engineer so that these officials may tell at any instant just what is going on in the engine room.

The engine room type, of indicator has a very long scale and prominent pointer. It may be read from a distance of 20 or 30 ft. and when placed in the line of vision of the man at the throttle enables him to bring his engine quickly and accurately to any desired speed.

The superiority of this means of engine control is very striking in comparison with the method of counting revolutions for a certain length of time, which at best gives only the average rate for some period rather than the actual rate for any instant.

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TO WATERPROOF WOOD paint it with zinc-white, rubbed down in glue water (size); after several hours, apply a coating of very dilute chloride of zinc, and the resultant combination will protect the wood from growths of mold and moss.

## PRACTICAL METHOD OF SEALING IN BATTERIES

By M. C. Saeger

SMALL portable storage batteries in glass jars are sold by the manufacturers at such a reasonable price that it does not pay them to go to any extra expense in sealing up the cells. When the batteries are received from the manufacturers they are sealed up with paraffin as shown in Fig. 1, K. The leading out terminals are small brass machine screws

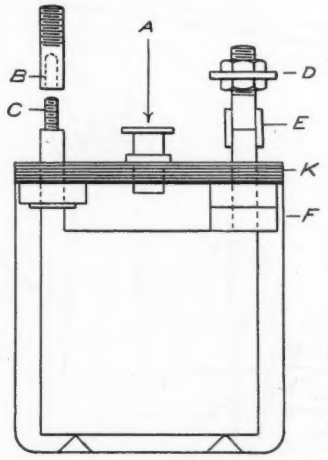



FIG. 1. STORAGE BATTERY SEALED WITH PARAFFIN

imbedded in the lead posts, capped by a hard rubber covered grass nut. The acid gas vent is a short glass tube as shown at A, Fig. 1.

The battery sealed up in this style will not stand daily handling, discharging and charging; continual heating of the acid due to charging will in time soften

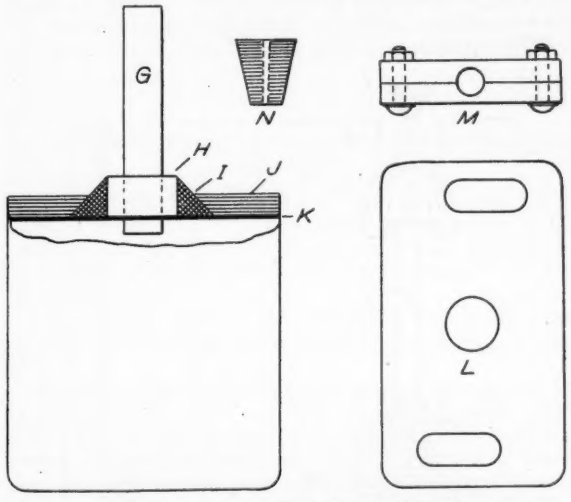



FIG. 2. DETAILS OF BATTERY PERMANENTLY SEALED

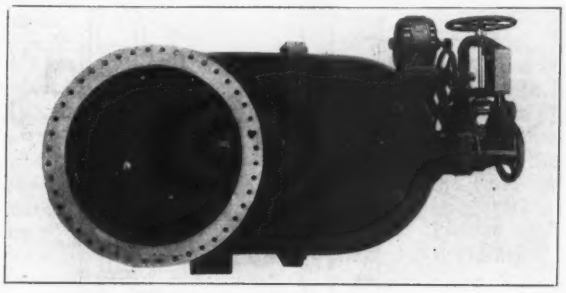
the paraffin sealing which will then drop down in the acid, making it impossible to take specific gravity readings with a hydrometer syringe. The brass binding posts will, in time, become corroded due to the action of the acid on the metal.

These difficulties can all be overcome by permanently sealing the batteries as shown in Fig. 2. Sheets are cut from 1/16-in. hard rubber of the shape shown at L and slipped down over the terminals and supported by rubber washers F; next a rubber washer is placed on top of the hard rubber sheet over the center hole at H and banked around the sides as in Fig. 2 with black sealing wax. A filter of coal tar compound is then covered over as at J, Fig. 2.

To treat the leading-out terminals first construct a mold for lead as shown at M. The lead should be one part antimony to 15 parts lead. The lead rods can be molded in 2-ft. lengths, one rod will answer for 12 batteries, sections being cut 1 in. long. The sections should then be drilled at one end and tapped to pass over the brass machine screw as at B and C, Fig. 1, after the section has been screwed down, the joint at E should be covered well with solder to prevent any acid from entering the joint and eating off the brass machine screw. Nuts and washers of aluminum are then placed on the lead terminals at D, Fig. 1. The rubber cork N is placed in washer H when the battery is discharging and is replaced by the glass tube G, while charging. The object of the long glass tube is to condense the acid gas while charging, also to keep the gas from forming a white sulphate on the aluminum nuts. Experiments have been carried on for several months with this type of battery in order to find the most practical method of sealing. This method represents the best results from a series of tests.

## MOTOR OPERATED GATE VALVE

THE large alternating current motor operated gate valve shown in the accompanying illustration is installed at the plant of the Pressed Steel Car Co., McKees Rocks, Pa., where it is inserted in the exhaust line from a 1,000-kw. Westinghouse low-pressure turbo-generator to the condenser. The valve closes upon a clear opening 48 in. in diameter, and is



GATE VALVE DRIVEN BY INDUCTION MOTOR

operated by a 3-hp., 3-phase, 60-cycle, 550-volt Westinghouse induction motor. The motor speed of 1,120 r. p. m. is reduced through suitable gearing to the speed of the main operating thread, proper for closing the valve safely and quickly. A hand wheel for hand closing is also provided. A worm gear on 1 of the intermediate shafts operates a limit switch mechanism, which automatically controls the movement of the gate by stopping the motor at a certain point in the gate travel either way.

To open or close the valve, it is thus only necessary to throw the operating switch into the corresponding position, starting the motor which continues to run until it is automatically cut off when the end of the valve travel is reached. The valve is thus operated with the absolute minimum of effort or trouble, and can be closed or opened at the predetermined safe operating speed as easily as switching on an electric light. The limit switch which accomplishes this automatic control is enclosed in the box shown at the right of the valve gear. The operator's switch, by which the valve is

opened or closed, may be located in any convenient position about the building or plant.

The assembly of the motor and gearing in the instance shown was a special construction made necessary in clearing neighboring pipes and walls. Applications of alternating-current motors for control services of this kind are yet in the classification of novelties, but the excellent performance of this apparatus has demonstrated that the induction motor is rapidly coming to occupy the wide field in which the direct-current motor has already proved so pre-eminently the ideal motive power.

The 48-in. gate valve illustrated was designed and built by the Pittsburg Valve Foundry & Construction Co., Pittsburg, Pa., and the motor and limit switch device were furnished by the Westinghouse Electric & Mfg. Co. of the same city.

## SAFETY DEVICES FOR ELEVATOR.*

By R. L. Mossman

FIGURE 4 shows the side and front elevation and the plan of the device mounted on the top of the car which is operated by the governor, Fig. 5, and whichi in turn operates the brake J, Fig. 6, to check the speed of car when from any cause the speed is high enough to cause the governor balls to raise. In Fig. 4 the cable C operates the governor as shown in Fig. 7. This cable is

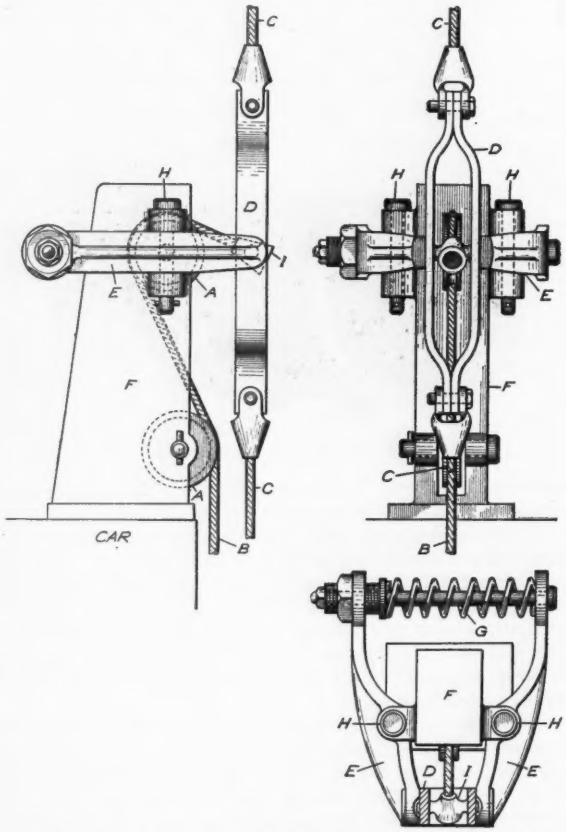



FIG. 4.—SIDE, END AND PLAN VIEWS OF SPEED LIMIT DEVICE

connected by a link D, Fig. 4, which link is held by clamps E E by the action of spring G. This causes cable C to move with the car. In link D at I is a pin to which is fastened cable B which passes around small sheaves A and A, Fig. 4, and extends to bottom of the

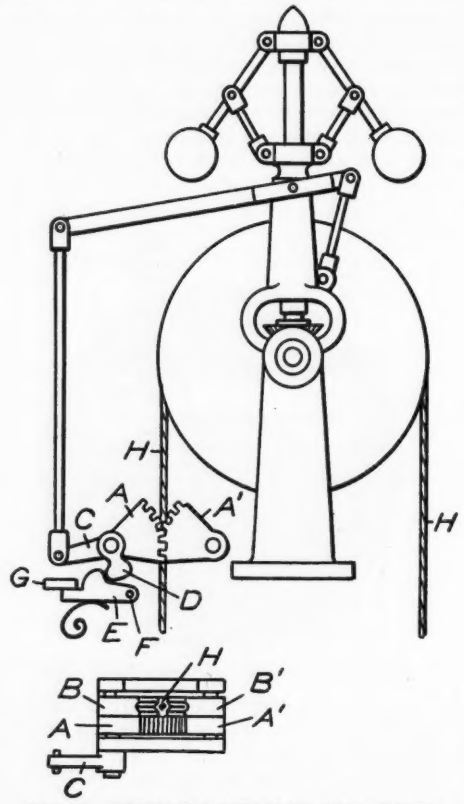



FIG. 5.—ELEVATOR GOVERNOR AND DETAIL

car, and is wound on grooved drum M', Fig. 6, which shows a plan of a portion of the bottom of the car.

The operation of this speed limit device is as fol-

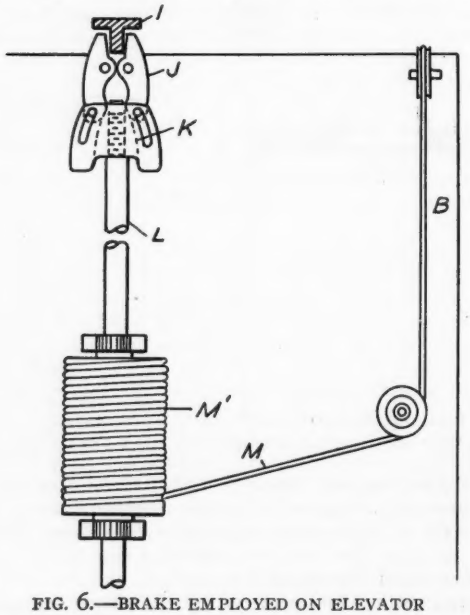



FIG. 6.—BRAKE EMPLOYED ON ELEVATOR

lows: When from excessive speed the governor acts, it will cause the claws B B', Fig. 5, to clamp the cable at H, this will check the cable and cause it to move at

(*Continued from page 193 of the March issue.)

a slower speed than the car which will cause the clamps E E, Fig. 4, to release the link D, and as the car continues to move it will draw the cable off the drum in Fig. 6 and revolve it with its shaft L. The screw on shaft L in wedge K will force the wedge into the jaws J and cause the jaws to grip the T rail I in the elevator shaft, and check the speed of car. It is understood that the opposite end of shaft L is fitted with jaws also, the

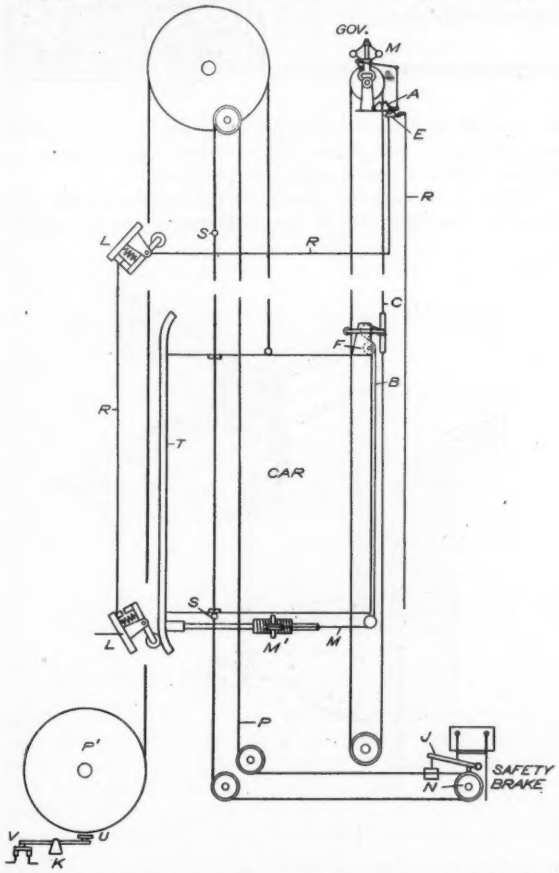



FIG. 7.—ARRANGEMENT OF DEVICES USED IN ELEVATOR EQUIPMENT

only difference being in the thread, one being right hand, and one left. The movement of cams B B', Fig. 5, also causes lug D to open switch E which breaks the direct current circuit and opens the switch C or D, on wiring diagram.

On the same shaft with cams B B', Fig. 5, are gear segments A A' which serve to keep cams in proper position.

Figure 7 shows the different devices as applied to the car, also the limit switches, L L, and slack cable switch K. As will be seen the limit switches L L are of very simple construction, they consist of a lever pivoted in the center with a pulley on one end, and a contact on the opposite end, they are operated by the rail T bolted to the side of car, the drawing shows the lower switch being opened by the rail T.

If from any cause the car should become wedged in the shaft and allow the cables to become slack, they will open the slack cable switch K and break the direct current circuit which will stop the motor. This switch consists of an arm pivoted at K with a piece U extending parallel with the axis of the winding drum P', when the cables become slack they will force U down which will open switch V.

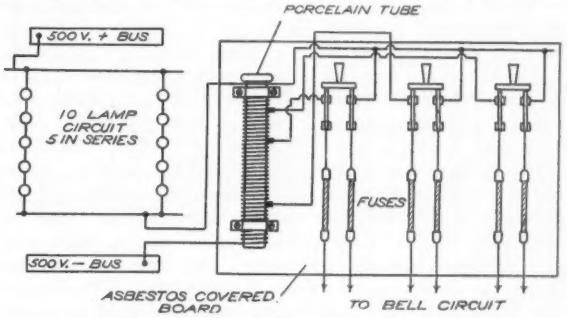
P shows the cable which operates the safety brake by the lugs on the car striking the stops S S on cable. The cables for operating the governor and speed limit device are also shown in Fig. 7 while R, R, R represents the direct current circuit through the various switches. The connection of slack cable switch is shown at K in wiring diagram.

## BELL ALARM CIRCUIT

By O. J. Bennett.

BELL circuits for circuit breaker alarms, indicating devices, etc., are usually more or less troublesome and expensive to maintain and for that reason I did some experimenting to try to obtain something to take the place of cells commonly used.

For the benefit of brother readers, I will give the results of my experiments, and perhaps thereby, help some one through a little difficulty. In the plant where I am employed there happened to be a bank of ceiling lights, 10 circuits, 5 lamps in series across




CIRCUIT FOR RINGING BELL ALARMS

500 volts. These are burning constantly and with this fact in mind, I devised a scheme as shown in the diagram.

The main feature is the coil of iron wire wound on the 1-in. porcelain bushing (inside measurement). A layer of sheet asbestos is under the wire to provide for the expansion and to prevent the wire from becoming loose. Iron wire was used, No. 19, mainly because it was the only wire available at the time and placed about 16 turns to the inch, making something like 70 ft. in all.

In winding I left taps at intervals, dividing the coil into about 5 sections. This allows the use of high or low resistance bells and a number of different bells may be used at the same time by making connection with different taps. It would be well to install a main switch and a pair of fuses for each circuit as shown, and also make certain that the arrangement is connected on the ground side of the main circuit.

It would be difficult to give definite data for an installation like this as each particular case must be worked out separately to suit prevailing conditions. With a little experimenting a neat and inexpensive price of apparatus may be constructed which will require practically no attention. The resistance necessary will be scarcely noticeable on the light of the lamps. It can also be adapted to a circuit of lamps on a 110 volt or 220 volt circuit, but must be direct current.

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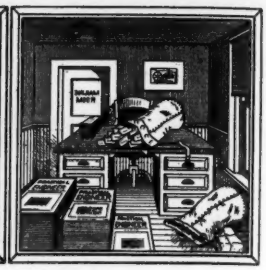
Tests of copper conductivity made at the mechanical laboratory of the Worcester Polytechnic Institute of Worcester, Mass., show that the thermal conductivity of rolled copper exceeds that of electrolytic copper not rolled by 30 per cent, due to change in the internal structure of the metal produced by mechanical treatment.

# Letters From Engineers

**Tell us about your new kinks and new thinks. Rough sketches are always helpful; we make the drawings. Cash paid for accepted contributions.**

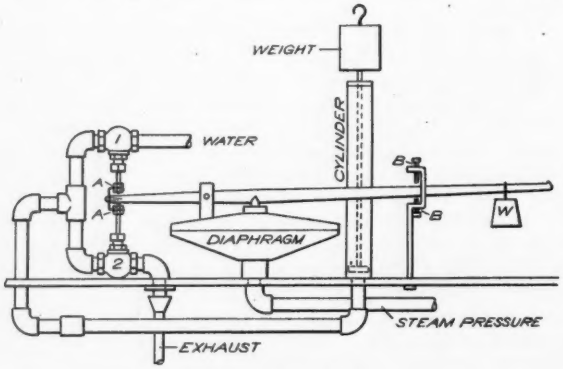


## Damper Control

Engineers who have their own firing to do and their engines to look after will appreciate a damper regulator to lessen their labor, I know I did. Any engineer can make one if he can procure an old diaphragm. The illustration shows the rig I made and the explanation is simple.

Take 2 ⅛-in. globe valves, file off the threads from the stem and connect them up as shown. If you have 80 lb. water pressure 1/16-in. opening is enough; at any rate do not have any more opening than is necessary for the lever will have to move further and it will not regulate so closely. Put adjusting nuts at A and B, to adjust the opening. Place the valve so the pressure will be on the top of the seat to insure that the lever will work quickly and the water will not blow through into the drip. The cylinder can be made out of 1 or 1.25-in. brass pipe with a little drip pipe soldered on to the side. All the connections should be made up of ⅛-in. pipe excepting the steam pipe leading to the diaphragm which should be ⅜-in.

The action of the regulator is as follows: Pressure under the diaphragm raises the lever opening valve 1 and closing 2, so water will not rush out at the




DAMPER REGULATOR

exhaust. This admits water to the cylinder, raising piston and weights, and closing damper. This condition remains till the pressure drops, thus lowering the lever which closes valve 1 and opens valve 2, and letting the water out of the cylinder.

If this regulator is made with care, placing soft packing around the valve stems and making all bearings knife-edge it will regulate the steam pressure within a few pounds. If you are firing heavily the damper should not be allowed to close entirely. Provide a damper cord and hook it down far enough to meet the conditions.

W. J. Race.

## Ingenious Packing Cutter

Herewith is a sketch of a home-made packing cutter. I have one of the cutters in my engine room and do the cutting of all the packing for all the engines and pumps in the plant. The object in having a cutter like this is to save time and packing.

After I completed my cutter I made out a table showing the lengths of the different sizes of packing

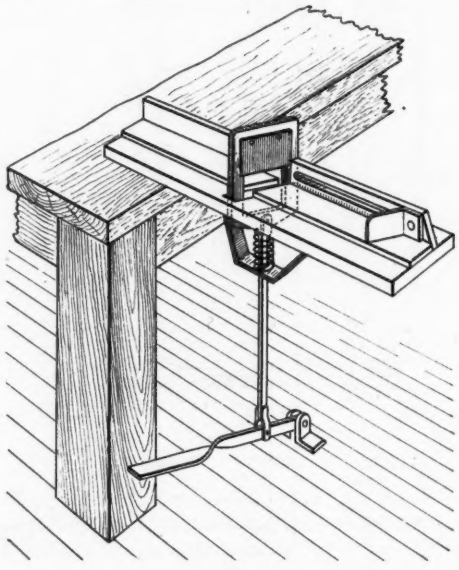


FIG. 1.—PACKING CUTTER ASSEMBLED

in inches required to reach around rods of different diameters. I had this table framed and keep it hanging beside the cutter, so when I want to pack my engine or pump all I need to know is the diameter of rod and size of packing. I can cut whatever amount is

TABLE OF LENGTHS OF PACKING FOR RINGS ON RODS

| DIAM. OF ROD, INS. | 3/8 | 1/2 | 5/8 | 3/4 | 7/8 | 1 | 1 1/4 | 1 1/2 | 1 3/4 | 2 | 2 1/4 | 2 1/2 | 2 3/4 | 3 | 3 1/4 | 3 1/2 | 3 3/4 | 4 | 4 1/2 | 5 | 5 1/2 | 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIZE OF PACKING | 1/4 | 2 | 2 1/2 | 3 | 3 1/4 | 3 3/4 | 4 1/4 | 4 1/2 | | | | | | | | | | | | | | |
| | 3/8 | | | 3 1/4 | 4 | 4 1/2 | 4 3/4 | 5 1/4 | 5 1/4 | 6 1/4 | 7 | 7 1/2 | | | | | | | | | | |
| | 1/2 | | | | | | | | 6 1/2 | 7 1/4 | 7 3/4 | 9 | 9 3/4 | 10 1/2 | 11 1/4 | 12 | 12 3/4 | 13 1/4 | 14 | 15 1/4 | 17 1/2 | 19 | 20 1/2 |
| | 5/8 | | | | | | | | | | 8 1/4 | 9 1/2 | 10 1/4 | 10 3/4 | 11 1/2 | 12 1/4 | 13 | 13 1/2 | 14 1/4 | 16 | 17 3/4 | 19 1/4 | 21 |
| | 3/4 | | | | | | | | | | | 9 3/4 | 10 1/2 | 11 | 11 3/4 | 12 1/2 | 13 1/4 | 13 3/4 | 14 1/2 | 16 1/2 | 18 | 19 1/2 | 21 1/4 |

required and then shut the engine or pump down and repack it. If I did not have packing cut in this way, after the engine or pump was stopped, the packing would have to be cut and fitted to the rod, and often the first cut is either too short or a little too long and this takes time and wastes packing.

Figure 1 shows the cutter assembled ready for use. It was made from strip steel as shown in the details, Fig. 2, and mounted on a board base. All bolts used were ¼-in. stove bolts except those used to fasten the cutter to the bench, which were ⅜-in. carriage bolts.

Wood screws fasten the bottom strips to the base board, and also the angle irons which hold the back

pieces. The spring used is of No. 7 B. & S. wire and was one formerly used to close the valve in a pump. It is 2 in. in diameter by 4.5 in. long.

To use the table, find the size packing in the vertical column at the left; follow along the horizontal

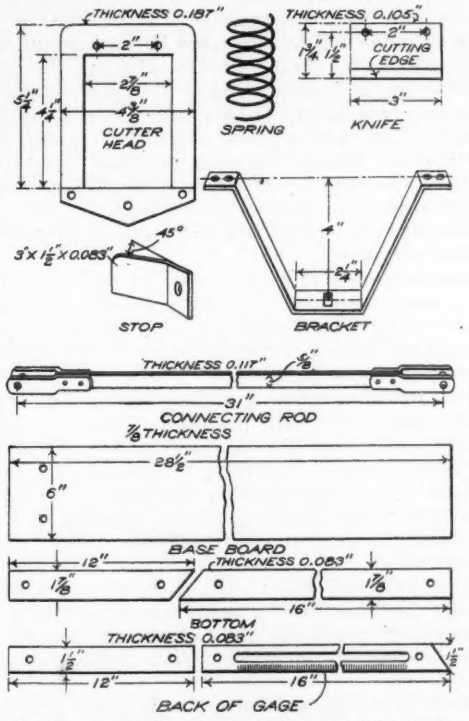



FIG. 2.—DETAILS AND DIMENSIONS OF PARTS

line to the column which has the rod diameter at the top, and the figure found is the inches length of packing required. Set the gage stop to this length and it cuts just the length required for a ring. For instance, to get a ⅜-in. packing ring for a ¾-in. rod, find ⅜ at the left; follow over to the column which has ¾ at the top and the length needed is 4 in.

W. H. Stivason.

## Hot Water Piping

It often occurs that the engineers will have to look after things that do not require an engineer at all. A young engineer friend of mine took charge of a small plant that did not require a license, but after he had been there for some time he called the writer to help solve some hot water trouble. He was in a 3-story building that was supplied with city water at 25 to 30 lb. pressure and there was a boiler for the heating of the water only. The main trouble was that he could not keep hot water at all unless he had an extra good fire. The water in the boiler would be hot and water in the tank was cold and there would be a knock or thump in tank.

After looking everything over we found the piping arrangement as shown in Fig. 1. There was a trap between the boiler and tank which required some work to remove, as the tank had to be raised and all piping had to be changed in some way or other.

When we brought the case before the manager he sent for his hot water man or men and their advice was to purchase a new tank or larger one; that meant $250, and we agreed to do our work for $75 and give good results or no pay. We got the work and with the aid of a bricklayer and steamfitter the work was done all right. The tank was raised 8 in. to remove the trap from the boiler and the knock was heard no more. It was the steam in the boiler coming in contact with cold water in tank.

You will observe in Fig. 1 that the feed for boiler comes from the street and passes through the tank, then to the boiler and back to the tank and from the tank to all parts of the building. By this arrangement there was a cold water return or circulating pipe that did not work. In Fig. 2 the feed enters the tank the same as Fig. 1 and leads down to within 4 in. of the bottom of the boiler and feed takes from the tank to the boiler at the other end. You will see by Fig. 2 the changes that were made. There is plenty of hot

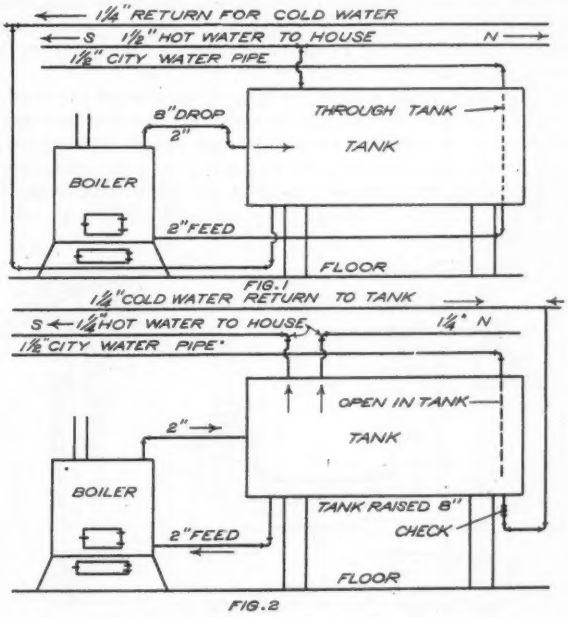



FIG. 1.—PIPING OF HEATER WHICH GAVE TROUBLE
FIG. 2.—CORRECT PIPING FOR HEATER

water now and no noise of any kind. This is accomplished by burning about half the coal used before and considerably less care. C. W. B. McCoy.

## Ye Joyous Lubricator

Now are the days when the chill winds of spring are here. Remove not ye winter undergarments from ye lubricator lest the cold freeze the oil and ye engine or pump grunt for grease and you be tempted to thaw ye lubricator with warm language.

Go now to ye big chief of ye plant and say ye persuasively, "Much my soul longs for a Rochester or a Manzel" and listen closely while he says to thee, "Son! the engineer whose place you took never had any trouble with that lubricator."

Then hie ye away even to the "Old Man" himself and repeat ye request and he will smile indulgently, but firmly and gently (?) say that "oil pumps cost money."

When the hot days come and duties are many, remember that ye lubricator gives down like a prize Holstein cow at cattle show, and while you are fixing the condenser in the basement, the oil may run out and the sight feed become like ye good wife's polka dot dress.

Remember that unless ye engine room be never too hot nor too cold ye lubricator must be regulated according to ye hotness or coldness. And if you work in

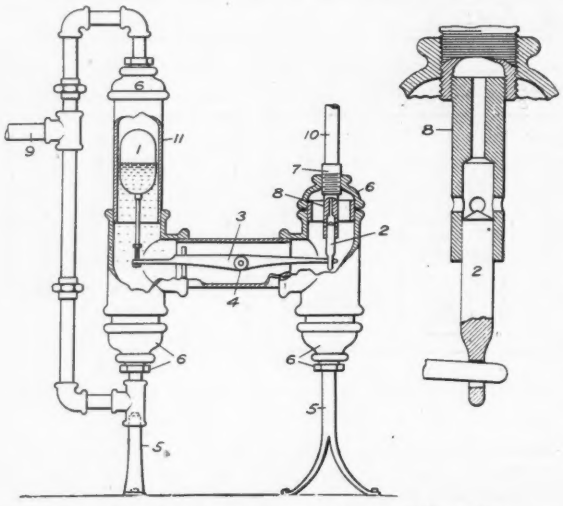
New England or Chicago where the breezes blow hot one day and cold the next, keep handy ye night jacket for ye lubricator that he may not get rheumatism from the chill winds. Care for him and he will serve you well. Neglect him and he will conspire to plague you with bothered days and mareish nights.

E. F. J.

### Home-Made Steam Trap

In the accompanying illustration is shown how I propose to make a steam trap out of pipe fittings and other pieces of apparatus which are available in any power plant. The float, 1, is taken from a water column, and the valve, 2, is made from a bronze bolt in which has been placed a slot at one end to receive the end of the lever, 3. The bearings for the lever are made from stuffing boxes and glands, taken from 2 2-in. gate valves.

The feet upon which the trap is supported are made from 1-in. piping, which is split at the bottom and each side drilled to receive a lag screw. Bushings and reducers are used at 6, and a 0.75-in. coupling, threaded on the outside, used at 7. The valve seat, 8, is made from a brass pump stud, and drilled as indicated in the detail drawing. The inlet and outlet pipes are at 9 and 10 respectively, and the piping used for the main body of the trap, 11, is 4 in. in diameter.




SECTIONAL VIEW OF HOME MADE STEAM TRAP

It will be noted that as the water in the trap rises, the float rises with it, and draws the valve, 2, from its seat, thus allowing water to be discharged, and as the float falls with the level of the water, its stem passes through the slot in the end of the lever until the upper nut comes in contact with the lever which then raises the valve to its seat. When the valve is in the discharging position it is perfectly balanced but when seated the difference in pressure between that in the trap and the discharge hold it to its seat.

Earl Watkins.

### Receiver Pressure

As E. A. B. says in the February issue, p. 142, it is generally conceded that to put more work on the low-pressure cylinder the receiver pressure must be raised. But it doesn't always follow that this will lower the steam consumption of the engine. In fact, the opposite is quite the case.

Receiver pressure is necessarily the back pressure on the high-pressure piston, and is opposing its motion during practically its entire stroke while the full receiver pressure acts upon the low-pressure cylinder only during a part of its stroke.

Or, to put it in different words, suppose that the receiver pressure is increased 5 lb. by the usual method of advancing the low-pressure cutoff, the m. e. p. in this cylinder will be increased by an amount, which is less than 5 lb. This will depend upon the time of cutoff before and after raising the receiver pressure, and would continually grow smaller as the cutoff was advanced. In fact, a point would be reached where a farther increase of receiver pressure would cause no corresponding rise in the m. e. p. To advance the low pressure any farther after reaching this point would lower the m. e. p. notwithstanding the increased receiver pressure.

Keeping these facts in mind, let us look into the high pressure cylinder. The back pressure opposes the motion of the piston during almost the entire stroke. It would act during the entire stroke but for the compression at the ends.

By combining these 2 actions we find, as was explained above, for one position of the low-pressure cut-off, an increase of receiver pressure will cause no increased m. e. p. in the low-pressure cylinder, but will increase the back pressure on the high-pressure piston. This must result in the governor working in a lower plane and the high-pressure cylinder taking steam a longer time.

It is only necessary then to continue raising the receiver pressure until a point would be found where the knockoff cam would not unhook, causing the high-pressure cylinder to take steam during the entire stroke.

Now, if we should raise the receiver pressure by admitting steam to it from some external source, it is evident that since the cutoff is not changed, there will be an increase in the low-pressure m. e. p. which, acting upon a greater piston area will more than compensate for the increased back pressure upon the high-pressure piston, which must result in an earlier cutoff on the high-pressure and more work on the low-pressure.

The ideal receiver pressure is that at which the engine will do its duty on the least amount of steam per horsepower-hour. The "Old Man" used to say "time is money." I might add "and so is coal."

J. M. Row.

Under the head "Compound Engine Receiver Pressure," E. A. B. describes some peculiar operating conditions in his plant and asks for help in solving the problem. He has neglected, however, to give data, important in working out his case. It is rather essential in troubles of this nature that in order to arrive at any definite conclusion we have the scale of spring, speed of engine, vacuum, and it is well to know from which end of the engine each card was taken, also the boiler pressure.

First, I doubt very much whether the cards shown represent the actual conditions of steam distribution in the engine cylinders from which these cards were taken, unless there are some defects in the valve gear.

Figs. 2 and 3 on one end, and Fig. 4 on both ends look as if the indicator drum came in contact with the stops before the engine had completed its stroke.

Figs. 1, 2, 3, show late admission on both ends. Fig. 2 showing later than any of them. Fig. 4 shows the admission about right. Now, if the 4 cards shown were taken from the same engine, with the same indicator, without any change in the valve setting and

the engine doing practically the same work on the same steam pressure, there is something radically wrong somewhere.

If I understand E. A. B. correctly he would have us believe that Figs. 2 and 4 were taken with the receiver pressure alike in both cases; if this is true, will he please tell us why Fig. 4 shows much more initial pressure than Fig. 2? Also, why is the atmospheric line in Fig. 1 nearer the card than in Fig. 3?

The expansion lines of all the cards indicate that the indicator piston does not move freely.

He says, "But in this case, if we raise the receiver pressure above 10 lb., it only backs up the high-pressure cylinder and causes it to carry the steam valve, taking steam full stroke." Card Fig. 1 I presume represents these conditions, but it looks to me like a short cutoff for an engine carrying steam full stroke especially where an engine has double eccentrics as no doubt this one has.

Granting that the cards shown represent the conditions as described, why does the engine act as it does?

To increase the receiver pressure it is necessary to shorten the cutoff in the low-pressure cylinder by manipulating the means provided for that purpose. When this is done the increase in receiver pressure is that much added to the back pressure on the high-pressure piston which is virtually the same as reducing the steam pressure that much.

In this case the increase in receiver pressure is not much, only 4 lb., but if the engine is doing about all it can on the steam pressure carried, this added back pressure will cause drop in speed which will lengthen the cutoff in the high-pressure cylinder and in the low as well to a certain extent making it necessary again to shorten the cutoff in the low-pressure cylinder to maintain 14 lb. receiver pressure. This operation is continued until a point is reached where the governor is down to its lowest working point, the high-pressure cylinder is taking steam full stroke, the boiler pressure falls no doubt, due to this fact and the horsepower of the high-pressure cylinder is materially reduced also, and even though the pressure on the low side is increased, the reduction in the speed of the engine eliminates the gain due to the 4-lb. rise in the receiver pressure.

Under the second condition as explained by E. A. B. the steam to increase the receiver pressure to 14 lb. is obtained not by shortening the low-pressure cutoff but by exhausting the pumps into the receiver. While the back pressure on the high-pressure piston will increase, as in the first case, the cutoff in the low-pressure being the same as when the receiver pressure was 10 lb. the increase in the receiver pressure acts on the low-pressure piston for a longer time than in the first case, consequently the horsepower for this cylinder will be increased in larger proportion than that in the high-pressure cylinder is decreased, hence the increase of the horsepower of the low-pressure cylinder as indicated by Fig. 4, the releasing of the load on the high-pressure cylinder as described by E. A. B. and the maintaining of the engine at its proper speed.

A. K. Vradenburgh.

In regard to the trouble that E. A. B. has with the high-pressure steam valves when he builds up the receiver pressure with its own steam, to me it appears that the engine is fully loaded, and at its longest cutoff, and running at an economical adjustment, and that when he tries to make the low-pressure cylinder do more work, by building up the receiver pressure, he causes the engine to be less economical with steam, and does not get the same amount of work out of the steam as he did before. This makes it take more steam on the high-pressure cylinder, making the steam valves carry.

Now, when you build up the receiver pressure from its own steam by shortening the cutoff on the low-pressure cylinder, it makes a higher initial pressure on that cylinder, causing it to do more work and the high-pressure less, on account of its higher back pressure. But when the pumps exhaust into the receiver which builds its pressure and the cutoff remains as it did before shortening it to build up the receiver pressure from its own steam it will have the same initial pressure, but a longer cutoff and a greater expansion

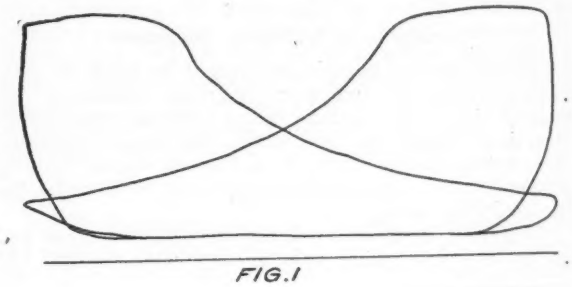


FIG. 1

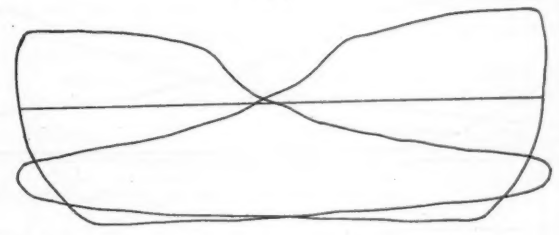


FIG. 2

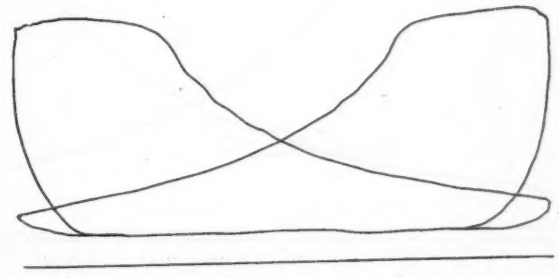


FIG. 3

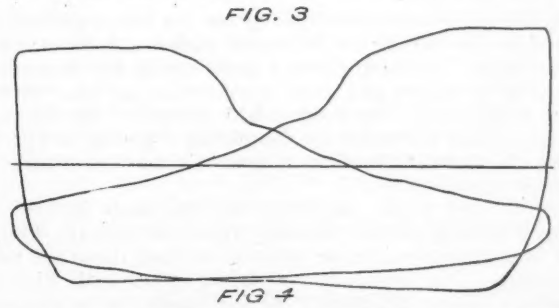


FIG 4

FIG. 1. HIGH-PRESSURE CARD WITH PUMP EXHAUST TURNED OUT OF RECEIVER

FIG. 2. LOW-PRESSURE CARD, PUMP EXHAUST TURNED OUTSIDE

FIG. 3. HIGH-PRESSURE CARD WITH PUMP EXHAUST USED IN RECEIVER

FIG. 4. LOW-PRESSURE CARD, PUMP EXHAUST USED

pressure. Therefore, the low-pressure cylinder will do more work, when the receiver pressure is raised by the exhaust from the pumps (as it is added energy) than when it is raised by building up her own receiver pressure. Causing the cutoff to be shorter in the high-pressure cylinder. L. T. K.

### Analysis of Indicator Diagrams

The following suggestions might be made in connection with the indicator diagrams submitted for analysis by J. A. Layman in the February number of Practical Engineer. He states that these diagrams were taken from a 12 by 18-in. Russell engine running at 220 r. p. m. with a boiler pressure of 70 lb. and a 54-lb. indicator spring.

Figure 1 represents a set of the cards as taken and about the first thing that is noticeable is that the

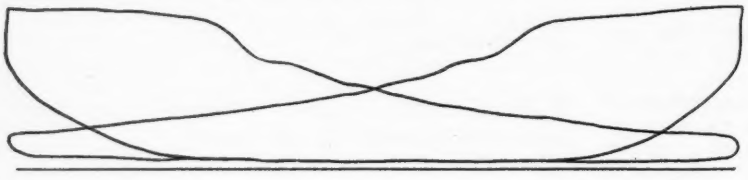


FIG. 1. DIAGRAM FROM RUSSELL ENGINE

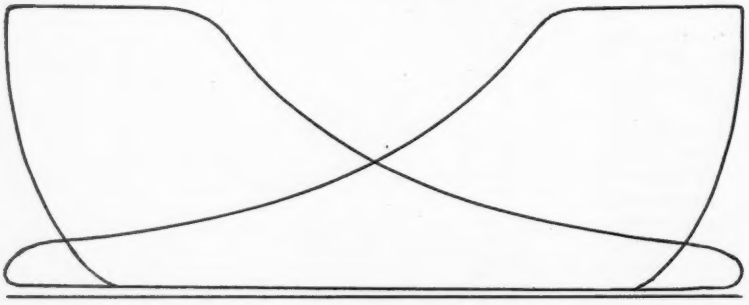


FIG. 2. THEORETICAL DIAGRAM

spring used was rather strong for the boiler pressure, and as a result the cards present rather a flattened appearance. By using about a 40-lb. spring the diagrams would be higher and more symmetrical and thus show up more clearly any good or bad features. The advantage of this is evident by comparing Fig. 1 with Fig. 2 which shows theoretical diagrams drawn to a larger scale of pressures.

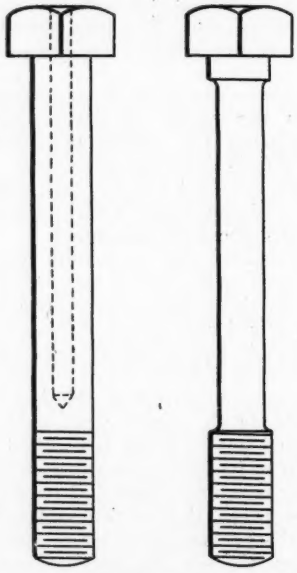
As they stand, however, the diagrams in Fig. 1 seem to be good and probably above the average. Only 1 or 2 defects might be pointed out and these are not serious. For instance, comparing them with Fig. 2, which shows practically perfect cards, it is noticed that the steam line is not horizontal but falls slightly as the piston moves forward. It might be inferred from this that the steam is throttled; that is, either the steam pipe or the port is too small for the required duty. A high piston speed would also produce this effect, but it is hardly likely that this is the cause in this case because the piston speed, while rather high, can hardly be called excessive. The engineer on the job who is familiar with the engine will probably know to which of these causes to attribute this defect.

Another point suggested by the comparison is that admission is probably a little too late, resulting in a trifle too much compression. This is shown by the admission line running straight up. This defect could probably be remedied by setting the valve so that the events will occur a little earlier and thus give earlier admission. If this adjustment were made it is altogether likely that it would in a measure affect the steam line, making it more nearly horizontal like in the theoretical diagrams.

Summing up, then, the cards are as a whole good, but the efficiency of the engine might be increased by making a few adjustments. The first thing to do would be to set the valve so that the events will occur earlier, and note results. If this does not bring the steam line to its proper position, then the causes which have been mentioned for its falling down should be investigated and eliminated if possible.—S. Hurley.

### Solid vs. Hollow Bolts

On page 146 of the February issue of Practical Engineer I notice that M. J. C. is at a loss to understand how a hollow connecting rod bolt can give better service than a solid one of the same diameter. Possibly the following explanation will help clear the matter up.



BOLTS WITH EQUAL TENSILE STRENGTH THROUGHOUT

A bolt that is subjected to repeated shock or stress suffers a slight temporary elongation every time the shock occurs. In a solid bolt the smallest area which is under stress is at the base of the threads between the nut and the body of the bolt and the slight elongation due to each shock is largely localized at this point causing the metal to crystallize and give way. By reducing the area of the body of the bolt until it is equal to or less than the area at the base of the threads the elongation distributes itself more uniformly through the entire length of the bolt and thus the strain on each particle of metal is less than when it is all located between the nut and the body of the bolt.

The area of the bolt can be reduced either by drilling out the center or by turning off the outside but as the latter method weakens the bolt more torsionally the drilling is preferable.

The 2 sketches will show how the bolts should be drilled or turned.—Chas. L. Thompson.

### The Starter's Pay

Referring to R. Cadwell's article in February issue of Practical Engineer, the feeling represented by this article concerning this runner, does not help to im-

prove conditions in any way. Possibly many of us were on the lucrative basis of starter stoper and runner once upon a time. If he is receiving $75 a month for this work he is very fortunate so far as the pay goes, because according to the article, many real engineers are not receiving so much, which would seem to indicate that the employer had rather employ a novice at a higher wage than to pay for a professional. That being the case seemingly it would be to our profit if we were all novices, and took up arms against the state license laws that we may secure better wage. Train the guns on the law making body of the state, and there explode your cannon and urge your reasons. Mr. Caldwell means all right, but this "starter" is not responsible for the lack of license laws, and I would not blame him if he were paid $1,000 a month for his work.—Thos. C. Robinson.

### State License Law

I most heartily agree with R. Caldwell on the need of state license laws and the quicker we get them the better.

Anybody who can start and stop an engine nowadays sets up for an engineer, and the good man gets a poor chance because the starter will often work for lower wages.

Engineer brothers, let us stand together for the betterment of our good profession; and this can only be done by digging and boosting for the state license law. —O. E. Morgan.

### Use of Ferrules

Hays Skaton on page 145 of the February issue asks several questions and in answer to them I wish to say that, unless the boilers showed considerable evidence of oil, the scale was the cause of the bagged boiler. Unless he is very economical with oil and does not use a grease extractor between the engine and heater some oil will get into the boiler. The patch should not leak when cold and will not if properly riveted and calked.

He further says he would like to know if it is the custom to use copper ferrules on the rear ends of boiler tubes. I do not think it is except when the tube holes are much too large for the tubes caused by frequent rolling or in an old boiler, then it is sometimes necessary to use a copper band around the tube to fill up the space and to prevent splitting the tube in rolling. I think that if he will get good tubes to fit the holes or put bands around them if they are very loose, by rolling them frequently thus beading the ends down, he will have better results than at present.

The master mechanic he speaks about has advanced the same ideas as one I worked for several years ago; he said "Copper ferrules are used on the tube ends of water tube boilers for safety, to prevent the tubes burning out as the copper melts at a lower temperature than the iron, and when it melts out will let the steam into the fire and put it out before the tubes are burned." But when you stop to think that the copper is rolled out to about 0.01 in. thick and is covered over with scale on the inside and is usually not in the hottest fire, there is small chance of its being burned out to save the tubes.

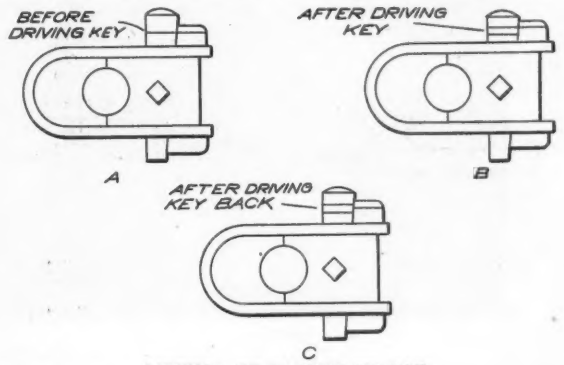
I have in mind a 15 hp. vertical boiler which was retubed and old barrel hoop iron used for bushings as the boiler was old and the holes badly stretched and there was danger of cracking the tubes in rolling. These tubes by the master mechanic's orders were not beaded over in the ends and it was necessary to reroll them nearly every week. This went on for several weeks until the writer was asked for suggestions, and he advised beading the tubes instead of rolling them; since this was done no further trouble has been given.

The reason for beading is this: if the tube is left straight the heat entering the projecting part of the tube has to travel lengthwise of the tube up past the tube sheet into the water, causing overheating at the end and upsetting or making the tube thicker as it expands, then when it cools off and contracts it will be loose. When the tube is beaded over it not only holds the sheet in its proper place but the heat passes from the end of the tube that is bent over up into the tube sheet and into the water.—J. C. Hawkins.

### Taking Up The Box

In the February issue of Practical Engineer under the heading Answers to Mass. Third Class Examination Questions I saw an article on taking up connecting rod boxes. Now I have a method something similar but which I think is a little safer, especially for young engineers.

I take a 2-ft. rule and lay it single thickness on the strap and draw a line with a pencil across key and gib




METHOD OF TAKING UP BOX

as in A, then I loosen the set screw and drive key pretty snug; then I lay the rule on strap again and draw a pencil line across the key to coincide with the one or gib as in B. I then drive the key back half the distance it has been driven, as in C and tighten the set screw.

Where bolts and wedge are used I slack up on the bottom bolt and tighten up the top one as tight as it will go, keeping count of how many turns I give the bolt then slack back half the number of turns, the bottom bolt is then tightened up. I have never had a hot crank or cross-head pin by using this method.—F. W. W.

### Cleaning New Engines

The article in a recent issue of Practical Engineer by C. R. McGahey concerning cleaning off new engines is only too true. I am having experience at the present time with engines that left the shop in a bad condition in that respect. Years of wear would not have done as much damage as the sand has in a short time. It certainly does not reflect well on the concern that built them, especially as it is doing a very large business and has a mighty good standing.—A Reader.

BEWARE OF THE WATER COLUMN with valves to shut it off from the boiler. Some day a valve will stick or somebody will forget to open it and, with the false water level shown there will be burned tubes to replace or a burned steam drum shell which may lead to an explosion. Keep the water column connections clear and fool proof.

## POWER PLANT OF THE LA SALLE HOTEL

(Continued from p. 221.)

### Generators

As stated above the generators are of the standard make of the Crocker-Wheeler Co., furnishing direct current at 250-volts. The machines are built with special ventilation, which enables them to run perfectly cool; they give a nearly flat efficiency curve, have low armature reaction and excellent commutation.

These generators are so constructed as to run in multiple with each other and take their proportionate share of the load.

To secure the advantages of the higher voltage, and yet have the lower voltage available for lamps, the 3-wire system is employed. The motors used about the building are connected to the 2 outside

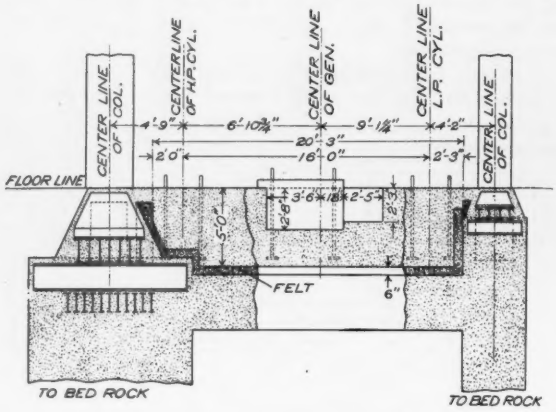



FIG. 12. FOUNDATION FOR THE 350-KW. GENERATING UNIT

wires, giving them the voltage of the generators, while lights receive half this voltage between the middle and either of the outside wires. By this arrangement the middle wire carries only the unbalanced current or difference between the loads on the 2 sides.

In order to overcome the difficulties arising from unbalanced load, 2 Crocker-Wheeler balancing compensators are employed, one of 20 and the other 15 kw. capacity. These balancers shown in Fig. 11 consist of 2 machines, mechanically connected together with the armature windings connected in series. They act automatically to supply the necessary current in the middle wire which is connected between the 2 armatures.

The switchboard was made by the Western Electric Co. and consists of 11 pannels containing illuminated dial indicating instruments, as well as recording instruments, circuit breakers and the necessary distributing switches.

### Engine Foundation

In a hotel plant one of the operating features which is positively essential is that the jar and noise of the machinery shall not be transmitted to the walls of the building and disturb the occupants upon the upper floors. To overcome this difficulty a special form of engine and generator foundation was designed, which employs a layer of felt 6 in. thick around the entire foundation as shown in the illustration, Fig. 12. The main part of the foundation is made of concrete.

### Elevator Pumps

Pumps which furnish the hydraulic power for operating the elevators comprise 1 main pump and 2 auxiliaries, all made by the Laidlaw-Dunn-Gordon Co., and run on high-pressure steam from the main header. The main pump has 2 flywheels, 3 cylinders, with 4 valve Corliss mechanism, 13, 16 and 16 by 4.25 by 13 in. being run by double expansion of steam. The reserve pumps are both direct acting, one being a simple duplex pump, 12 by 4⅜ by 18 in., the other a compound pump with cylinders 10 and 16 by 4⅜ by 16 in. The steam supplied to these elevator pumps is controlled automatically according to the accumulator position. The suction pressure on the elevator pumps is about 140 lb. and the discharge 800 lb.; the valves and fittings used in the pipe lines are the product of the Crane Co.

### Fire Pumps

For fire protection, an Underwriters Fire Pump is employed with the dimensions 18 by 10 by 12 in., which is capable of delivering 1,000 gal. per minute, and

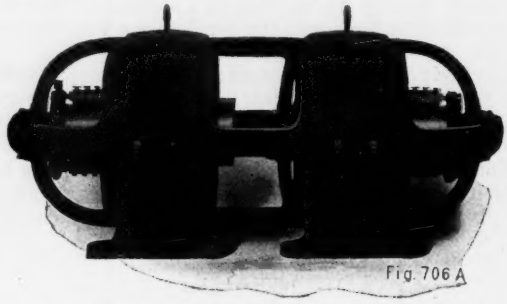



FIG. 13. CROCKER-WHEELER BALANCING TRANSFORMER

maintains a pressure at all times of 120 lb. upon the system, this pressure being kept constant by a pressure regulator made by the Crane Co.

The house water supply is furnished by 2 direct acting steam pumps, 12 by 8 by 12 in., made by the Platt Iron Works Co. These pumps maintain a constant pressure of 150 lb. by means of Fisher governors. On all the water piping of the house Nelson fittings are employed.

For heating the water used about the house, 3 Berryman closed feed-water heaters and purifiers, made by I. B. Davis & Son, are employed. In these heaters exhaust steam is used, which is supplied through back pressure valves.

The vacuum plant for steam heating is employed and for maintaining the vacuum 2 direct acting steam pumps are employed, 10 by 16 by 16 in., made by the Knowles Steam Pump Works. These pumps are provided with a regulator supplied by the Illinois Engineering Co., and maintain a vacuum of 8 in. when the back pressure on the engine is 2 lb.

There are 3 air pressure systems employed about the house; one is used for blowing out the generators and other purposes about the engine room. It is maintained at a pressure of 65 lb. by a 10 by 10 in. chain-driven air compressor made by the Laidlaw-Dunn-Gordon Co., and driven by a 25-hp. C. & C. motor which is controlled automatically by a Cutler-Hammer starter.

Another air compressor is used for supplying air to the accumulator used in the elevator system. It is a Westinghouse Air Brake Co.'s compressor, 8 by 8 by 10 in., and is located behind the elevator pump.

The third system is for operating the pneumatic tubes employed in the cash system of the hotel. For operating these, 2 blowers are used which were made by the Connorsville Blower Co., and these are driven

by 10-hp. Allis-Chalmers intermittent direct-current motors.

The main ejector, which is used for delivering the sewage of the building to the city sewer main, is located in the engine room. The equipment consists of a Yeoman combined duplex electric ejector and pit pump which is operated by 2 220-volt 9-hp. motors running at 100 r. p. m. Besides this there is a kitchen ejector, which delivers the sewage from the kitchen to the sewer pipes. This is of the same make as the main ejector, but is operated with 1 9-hp. motor instead of 2.

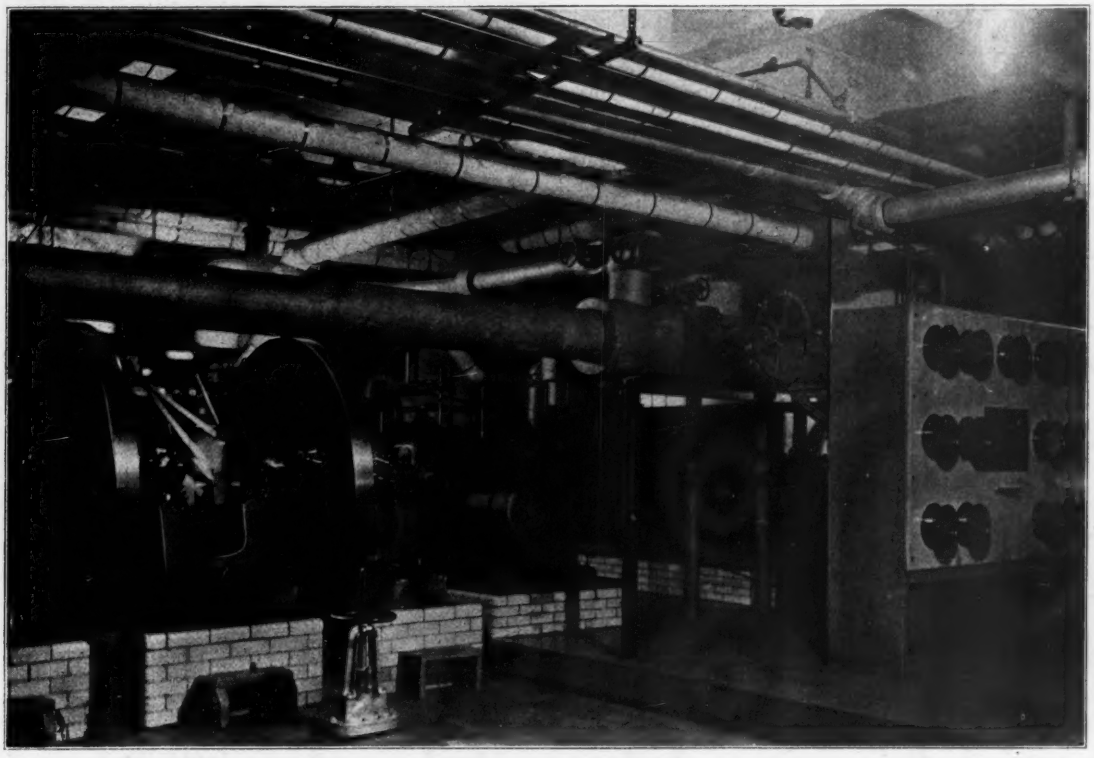


FIG. 15. ELEVATOR PUMPS

All sweeping about the hotel is done with vacuum sweepers, the dust being delivered into 3 cylinders in the engine room. The system employed is that known as the Aero System, devised by the American Air Cleaning Co., which employs a steam jet for maintaining a vacuum.

### Refrigerator Outfit

In looking after the comfort of guests in a hotel, it is essential that the refrigeration end of the power plant be given careful consideration, and apparatus provided which will not only furnish cold drinking water, and cold storage for the vegetables and meats but will also provide a cool atmosphere for the parlors, lobbies, dining rooms and rest rooms during the hot days of Summer. The refrigeration outfit in this hotel occupies a large space in the power plant. All of this apparatus is the product of the Carbondale Mfg. Co., and is on the absorption system.

One of the novel features in the LaSalle Hotel is the fact that both heating and cooling of the atmosphere is done by means of exhaust steam. In the refrigeration equipment there are 2 generators, each having its complete set of auxiliaries.

One generator has a capacity of 50 tons refrigeration in 24 hr.; it is made of welded steel and known as the shell type. This generator is heated by exhaust steam at 20 lb. pressure from the brine and ammonia pumps, used in connection with it. The generator is provided with a back pressure valve which will, in case of necessity, admit steam from the main piping when the exhaust from the pumps is not sufficient for the requirements.

This unit is used for making ice, cooling refrigerators and drinking water. There are, therefore, 2 brine systems in connection with the apparatus, one being used for circulating the brine in the freezing tank and for refrigeration purposes in the kitchen. This is run at a low pressure. The other pump is run

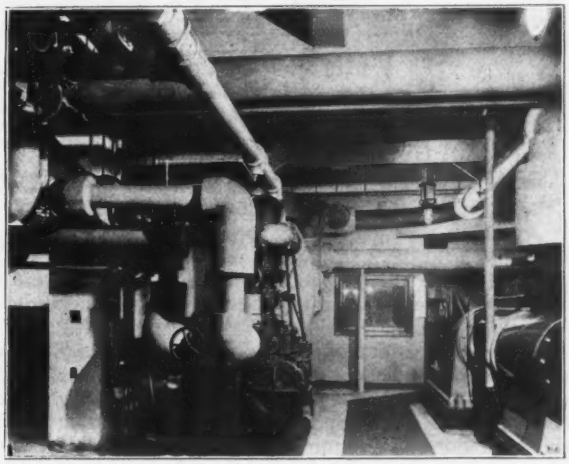


FIG. 16. FIRE PUMP WITH ENGINEER'S OFFICE IN BACKGROUND

at high pressure and is used to circulate the brine to the service cooling boxes and drinking fountains on the various floors to the top of the building.

An ice tank is provided for making ice on the can system, the rating of the freezing outfit being 7 tons of ice in 24 hr.

Water used in making the ice is procured by condensing the exhaust from the engines which is afterward reboiled and purified. The plant is equipped further with an ice crusher and a Blakeslee Ice Cuber galvanized pipe. Each bunker is provided with a fan which will deliver the cool air from the coils to the desired part of the building, the system being designed to lower the temperature of the atmosphere in the rooms to which air is supplied, 10 deg. F. below the normal temperature of the air. The power required for refrigeration in this system is about 0.1 hp. for one ton of refrigeration.

The cooling water which is used for condensing the ammonia gas is afterward used about the plant

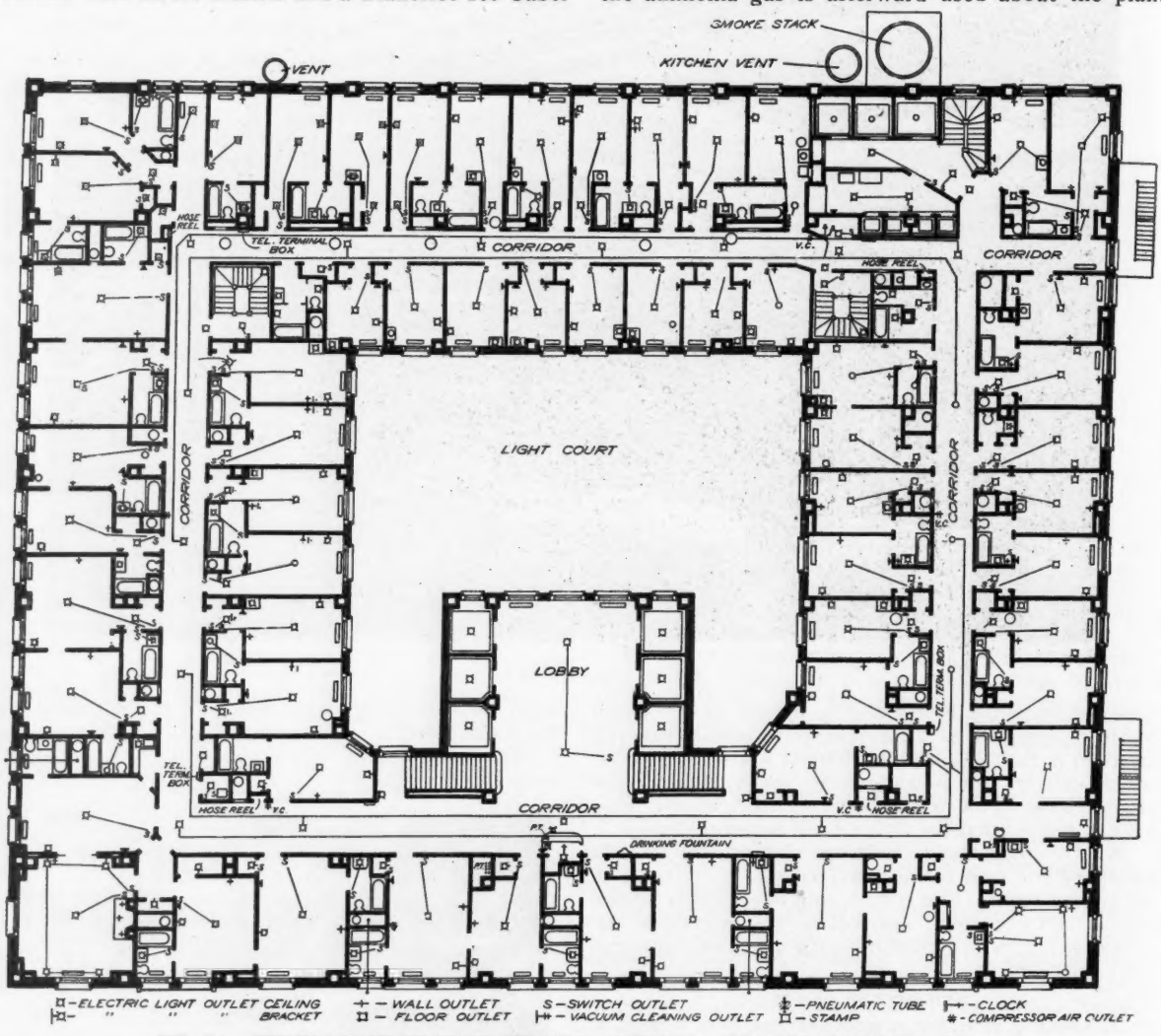



FIG. 14. TYPICAL PLAN OF FLOOR SHOWING LIGHTING, HEATING, PLUMBING, ETC.

through which the cakes are run when ice of these dimensions is desired for any purpose about the building.

The other generator is rated at a capacity of 75 tons refrigeration in 24 hr. and is also made of welded steel but is of the tubular type with double pipe condenser and double pipe absorber. The operation of this unit does not require an analyzer and this piece of apparatus is omitted. In this generator, heat is furnished by exhaust steam from the engines at from 2 to 3 lb. pressure.

This outfit is to be used exclusively for cooling the atmosphere in the main rooms of the hotel during the hot days of summer. The cold brine therefore, is pumped from the cooler through 3 bunkers or cooling coils which contain a total of 20,000 ft. of 1.25 in. for feeding to the boiler or other purposes where a small rise in temperature does not affect its use.

### Air Purification

For purifying the air, which is supplied to the various large rooms of the hotel, Acme air washers are employed. These consist of a series of water jets which impinge against a flat surface, and form a series of water sheets through which the air is passed before it goes to the heating or cooling coils. For circulating this wash water 2 centrifugal pumps driven by direct connected motors are employed, which were made by Thomas & Smith. The temperature of the air in the washer is maintained at about 40 deg. F., which is increased to 70 deg. at the entrance to the blower. There are 4 of these 110 in. blowers, each 66 in. in diameter

by 20.5 in. in width which are connected directly to 12-hp. C & C motors running at 330 r. p. m. and having Cutler-Hammer starters.

The main exhauster is a 140-in. fan, and is driven by a 12-hp. motor direct connected to it. The exhauster for the engine and boiler room is a 140-in. fan made by Andrews & Johnson. This is run by a 25-hp. C & C motor direct connected to it, and is also equipped with a Cutler-Hammer starting rear shaft.

### Steam Piping

The limited space and head room which are available in the engine room made necessary a complicated system of steam piping. The high pressure steam piping is divided into 2 sections, one supplying the main generator engines and pumps and the other used to supply the auxiliary pumps and so forth.

The steam pipes from the boiler lead to a main 14-in. steam header and from this the main steam pipe is led in a loop to the principal generators and pumps. This piping system is sufficiently provided with gate and by-pass valves, to make it possible to use almost any section of the loop and eliminate condensation in the unused pipe. The pipes leading to the various engines and pumps are all provided with Cochrane steam separators, which drain the pipes of water and Jenkin's steam fittings are used throughout.

The auxiliary steam piping is arranged on the same general principle as the main system, but is, of course, more complicated. In the steam lines where water is apt to collect emergency steam traps are provided to maintain try pipes.

All steam piping is thoroughly covered with magnesia insulation to prevent all possible condensation of the steam. The exhaust steam main is located in a tunnel, underneath the main aisle of the engine room, and to this center is piped all the exhaust steam of the engine room.

On all pumps and engines some system for mechanically forcing the oil to the wearing parts is employed. The systems in use are the Hills McCanna, John McCanna and the Detroit Lubricator, all of which are automatic and adjustable to suit the needs of the apparatus.

Holabird & Roche of Chicago did all the architectural work on this magnificent hotel and J. B. Blake, who is the consulting engineer for this firm, had charge of the mechanical design of the building equipment.

The heating and ventilating system was installed by the Johnson Service Co. and gives remarkable satisfaction in maintaining the proper temperature and providing pure fresh air.

The chief engineer of the hotel is J. E. Lawrence, to whom the efficient operation of the power plant and the well kept condition of all its apparatus are due. For his convenience the plant is provided with office rooms which add materially to the service the engineer and his assistants are able to perform.

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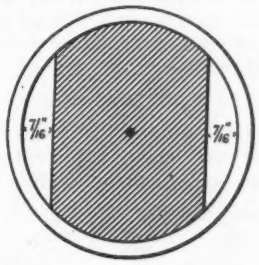
TO PROTECT LEATHER from acid action a good varnish is made by taking gall nuts 200 parts, logwood 30 parts, water 200 parts. Boil these for 2 hr., the water evaporated to be replaced from time to time, and filter what remains. Dissolve in the filtrate 40 parts green vitriol, 200 parts brown syrup, and boil the fluid again until it begins to thicken; then add a solution of 10 parts of ruby shellac in 30 parts of strong alcohol. Keep in tightly closed bottles and apply with a brush as needed. This will not do for belts and other leather subject to bending.

## AN ENGINEERING FREAK

A CERTAIN tannery in New England was fitted out, many years ago, with a small slide-valve engine, which was operated at a pressure of 70 or 80 lb. per square inch, and which proved to be adequate, until quite recently, to the wants of the plant. We do not recall the dimensions of the engine, except that the exhaust pipe was 3 in. in diameter, internally; nor do we know the exact date when the engine was installed. Inquiry elicited the fact, however, that no repairs had been made upon it within 35 yr.; hence the state of affairs that we are about to describe had existed for that period, at least.

A short time ago the owners of the plant decided to throw out the old engine, and replace it with one of the Corliss type, capable of furnishing more power.




END VIEW OF EXHAUST PIPE

Upon taking the old engine down it was discovered that the exhaust pipe was almost completely closed by means of a piece of cast iron, of the general appearance indicated by the shaded part of the accompanying sketch. On each side of the cast-iron piece there was a segment-shaped space, 7/16 in. wide at its widest part; and the entire exhaust of the engine had to pass through these 2 openings for 35 yr. or more.

Engineers of the older school will see at once how the thing came about; but for the benefit of the youngsters it may be well to explain. In former years it was customary to thread all steam piping except the very smallest, by turning the threads upon it in a lathe. In order to secure the pipe properly in the lathe, it was necessary to provide a center piece which would fit inside the end of the pipe, and in which a hole could be made, to receive the tail-center of the lathe. The center piece was of course supposed to be removed, after the completion of the thread; but in the case now before us, this detail of the operation was forgotten and the pipe was put in place, center piece and all.

The editor could use up a lot of space in trying to estimate the waste of coal that this forgotten center piece has caused, and in comparing this loss with the cost of a good indicator; but he isn't going to. No indicator was ever applied to the engine; and we are not going to show the owners of the plant how big a mistake that omission was.—The Locomotive.

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FOR FIREPROOF PAINT mix 35 parts zinc white with 15 parts air-slaked lime, grinding them, and adding oil. Then add 4.5 parts of water glass (35 per cent). Next add 25 parts white lead and 5 parts sulphate of zinc stirring all well together, which gives a white paint. Coloring matter may be used to give any desired tint.

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RECENT WIRELESS TELEGRAPH transmission was recorded by the steamship "Tennessee," 5 days out from Honolulu, catching a message from Table Bluff on the coast of California, a distance of 4,580 miles. The message was a weather report, which was afterward verified by the Navy Department.

# VALVE DIAGRAMS--I

## WHAT'S THE USE OF SUCH SPIDER WEBS?

WELL it's easy enough to trace out from a model of the valve and the seat and from the crank and connecting rod diagram how a valve will work, and, of course, by trying enough different valves you can find one that will give the results that you are looking for. But that's a slow process and not in line with modern progress or good engineering.

To get a method which is not cut and try, we must use either analytical work, that is figuring by rules and formulas or graphical—working out drawings to show the valve action. And the latter method is much easier and more satisfactory even if it does give some rather complicated looking figures. They're very simple when you understand them.

### Lap, Lead, Etc.

Of course you know that the plain D valve like Fig. 1 will work but takes steam full stroke, and that it has the eccentric set 90 deg. ahead of the crank for a direct

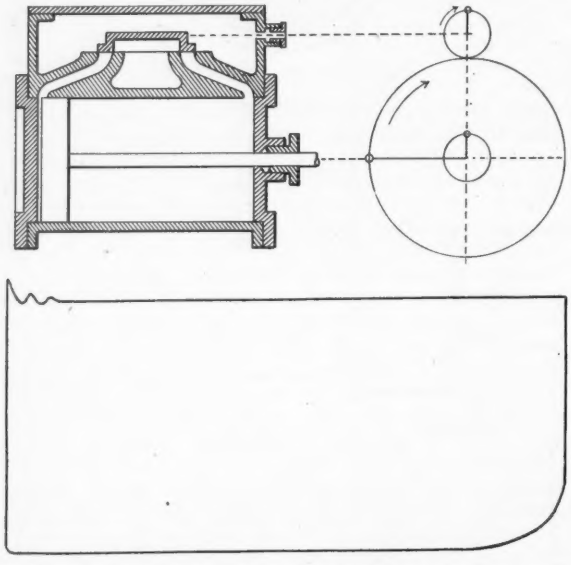


FIG. 1. PLAIN D VALVE AND THE DIAGRAM THAT IT GIVES

connected valve or 90 deg. behind the crank if a rocker arm is used which reverses the eccentric motion. And also that, to use steam expansively it is necessary to put some metal on the end of the valve so as to "cut off" early, and then the eccentric has to be set forward from its 90-deg. position in order to admit steam at the beginning of the stroke. That gives "lap angle," ma, Fig. 2.

And then too, if steam pressure is to be up full when the piston starts forward, the valve has to open a little early and we call that lead; and as we get this early opening by turning the eccentric ahead a little more, that gives the "lead angle," ad. The "angle of advance" is the sum of those two angles, md, and is, of course, the angle that the eccentric really stands ahead of the 90-deg. position when the valve is set right for running.

There are a few other terms that we want to get right, as they will be coming up all the time. Valve travel, the distance that the valve moves from one end of its stroke to the other; mid position, where the valve stands when half its travel from one end of the stroke: eccentricity, the distance from shaft center to eccentric center and equal to half the valve travel; and port opening, the amount that the valve travels past the port edge after opening, and it may be more or less than the width of the port itself. That will do for a starter and the idea of these and other terms will come clearer as we use them in the diagrams.

In Fig. 2 the valve opens when the crank is at A and the eccentric at a. The valve has steam lap = ma and exhaust lap zero. From a around to c the steam valve is open, and cutoff comes with crank at C. Release comes when the eccentric is at r and the crank at R, and exhaust closes with the eccentric at m and

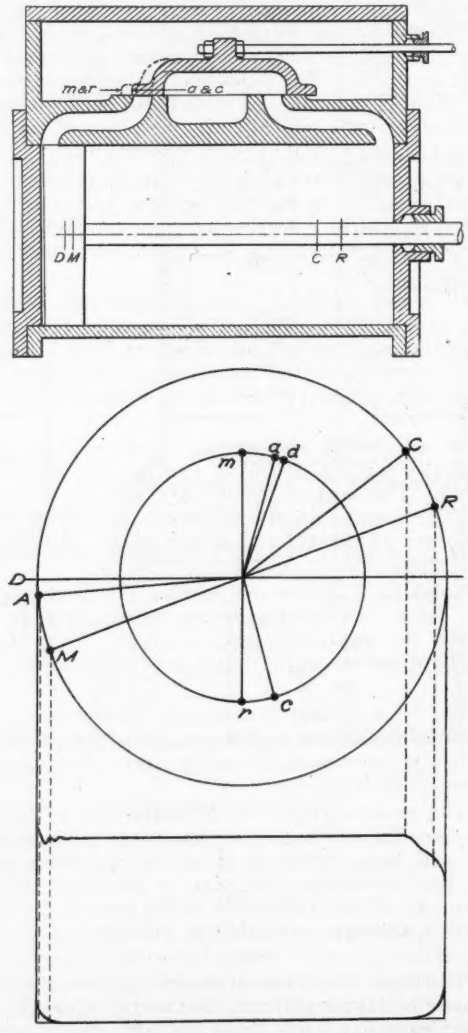



FIG. 2. D VALVE ACTION WITH LAP AND LEAD SHOWING ANGULAR ADJUSTMENT OF THE ECCENTRIC

crank at M. Leaving out the connecting rod effect, the diagram would be as shown below the crank circle and differs from Fig. 1 in having compression, early admission, cutoff before the end of the stroke and early release.

### Valve Study

Sometimes the conditions for the engine give exactly the way that the valve must work. More often there are several things wanted in the steam distribution and all of them cannot be worked into one design so that it becomes necessary to study the effect of changes in lap, lead and travel. The diagram gives the means of doing this quickly and also of determining what valve will, on the whole give best results.

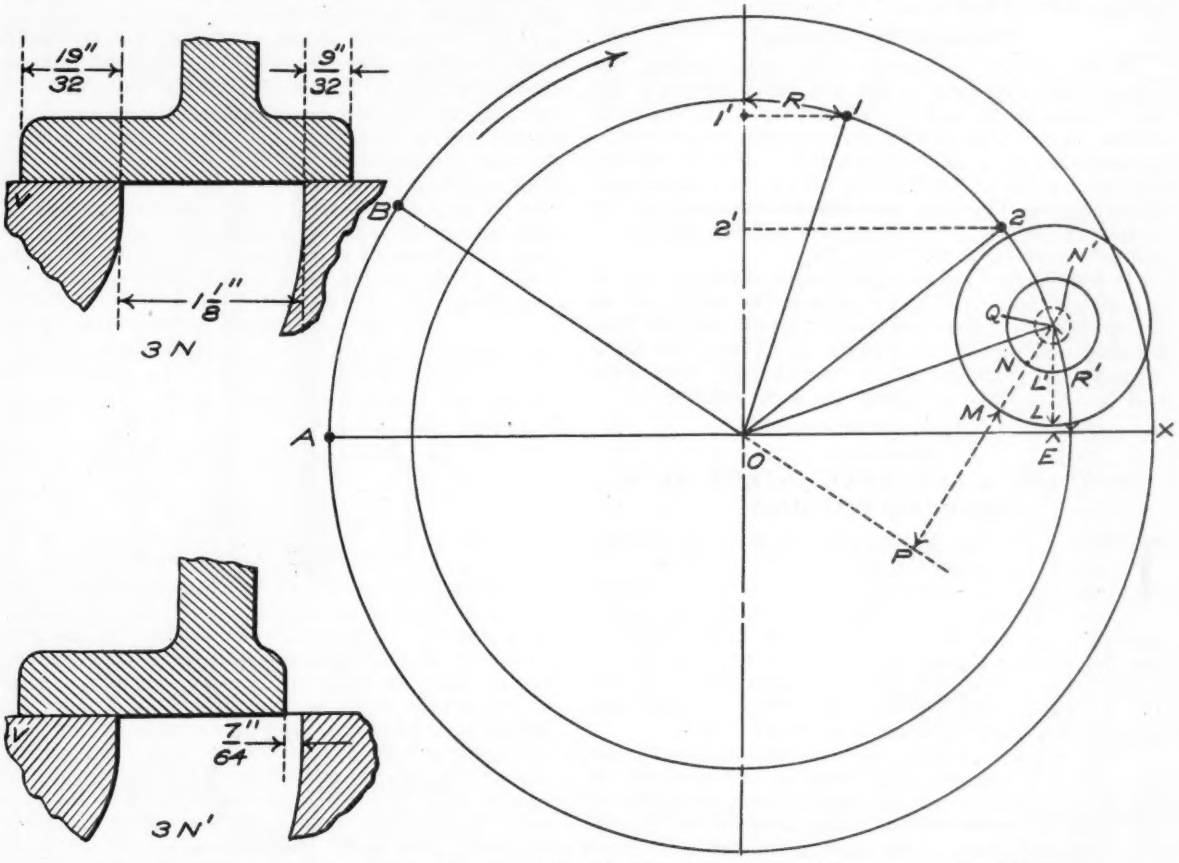



FIG. 3. CONSTRUCTION OF THE BILGRAM VALVE DIAGRAM AND ITS RELATION TO VALVE DIMENSIONS

First it is necessary to find how the diagram is derived and this is the method followed by Hugo Bilgram who devised it.

### The Why and How of the Diagram

In steam distribution the action is always based on piston position and the crank position for any piston position should be found from the cross head position using the connecting rod. For the sake of simplicity however, it will be assumed for a time that the crank positions are known so as to avoid using the connecting rod.

Consider that OA on Fig 3 is the crank position at dead point and O1 the corresponding eccentric position; then R is the angle of advance and 1-1′ is the distance of the valve from mid-position.

Of course the eccentric and crank are actually on the same shaft so that the circles should be drawn from the same center. Valve motion may be considered the same as the horizontal motion of the eccentric without error because the eccentric rod is so long compared to the eccentricity that its angular motion does not affect the valve travel.

The circle OA is usually drawn to a reduced scale for convenience and the eccentric circle full size for clearness. The two need not be on the same scale as the only relation between them on the diagram is one of angles, and this does not depend on the size of the circles. OA represents a crank 5 in. long to ½ size and O1 an eccentricity of 2 in. full size, giving valve travel of 4 in.

Let OB be any other crank position and O2 the corresponding eccentric position, which will, of course, be the same angle ahead of OB that O1 is ahead of OA. The line 2-2′ will show the valve displacement for this eccentric position.

### Finding Valve Displacement

From OX lay upward an angle R′ equal to the angle R, and letter the intersection of this radius with the eccentric circle Q. Prolong BO through O and drop a perpendicular from Q upon this prolonged line, and it will be found that QP = 2-2′. Any valve displacement can therefore be found by drawing a line from Q perpendicular to the crank position line, prolonged if necessary, and measuring the distance from Q to this crank position line.

### Port Opening

Steam port opening is the difference between the valve displacement and the lap, so that, if we lay off the lap from Q on the line QP, the remainder of that line will be the port opening. As the lap is constant, we may draw a circle with the lap as a radius and Q as a center and the distance from that circle to the prolonged crank position, or as we will now call it simply the "crank line," will give the port opening for the

head end of the cylinder for any crank position. For the position B, the port opening will be MP.

**Lead**

For the crank position OA the valve displacement is QE and the port opening, which is the lead, is LE. Measurement shows that this is 1/32 in., the lap QL being 19/32 in.

For the crank position B, measurement shows that the valve displacement QP is 1 9/16 in. and the port opening MP is 31/32 in.

**Exhaust Port Opening**

In like manner as for the steam port opening, the exhaust port opening is the difference between the valve displacement and the exhaust lap. This lap is of course, on the edge of the valve opposite to the steam lap, and may be positive or negative. If it is positive and has a value of 9/32 in., lay off QN = 9/32 in. and draw a circle. The crank end exhaust port opening for position B will be NP = 1 9/32 in. and for position A will be L'E = 11/32 in.

If the exhaust lap is negative, the distance will be laid off on the side of Q away from the crank line at N' which is for a negative lap of 7/64 in., and the port opening will be PN' or 1 43/64 in. The circle for a negative lap is drawn dotted to make sure that there will be no mistake in taking the measurement.

(To be continued.)

## PUTTING A CONCRETE JACKET ON A CRACKED CHIMNEY

TWO points of considerable engineering interest stand out from the facts of the work recently done by the Aberthaw Construction Co. of Boston, in putting a reinforced concrete jacket around a cracked and leaky chimney in the plant of the Winchester Repeating Arms Co., at New Haven, Conn. The job was of rather peculiar character, but the method by which it was done offers practical suggestions for handling work of different details.

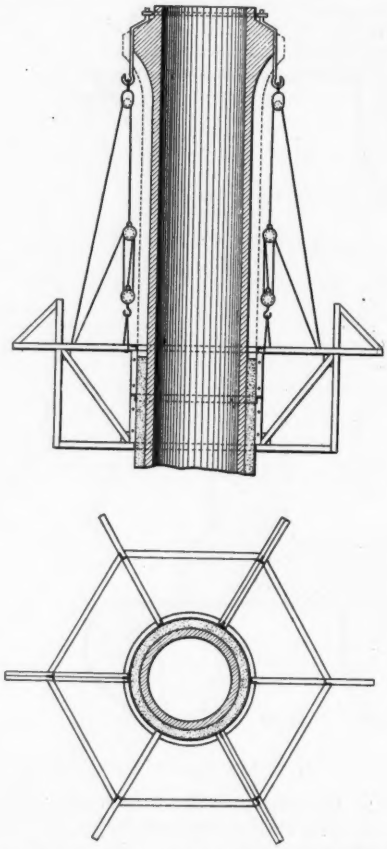
The original chimney was of reinforced concrete, but it had developed large vertical cracks which allowed the escape of smoke and at times the inflow of air, both of these actions being harmful to the efficiency of the draft. This chimney rested on a brick foundation which was part of the power house building. Above this foundation it was about 80 ft., with an outside diameter of 8 ft. at the bottom and 6 ft. at the top; it was 4 ft. in diameter, inside, and was unlined. The old concrete, forming a well about 4 in. thick in the cylindrical part of the chimney, had proved seriously defective, aside from developing cracks.

It had been laid as a stiff, dry mortar, without stone, and by the time the Aberthaw Co. took hold of the job the mortar had become so soft and "punky" that it crumbled easily under a blow, and came away from the reinforcing metal with dangerous readiness.

The new concrete jacket put about the old chimney by the Aberthaw Co. was 5 in. thick over the whole surface of the old structure. The vertical reinforcement consisted of 4 sets of square twisted steel bars with 32 in each set, equally spaced, and with the ends of the successive sets lapped. The lowest set of bars, 5/8 in. thick and 20 ft. long, were upset at their lower ends to 0.75 in. diameter, and were screwed into an anchor ring 4 in. wide by 0.5 in. thick sunk in the brick work at the base of the chimney. The other 3 sets of vertical bars were 0.5 in. square and 24, 22 and 20 ft. long, respectively. Outside this system of lapped vertical bars were placed a series of horizontal hoops of 3/8-in. square twisted steel, spaced 6 in. The concrete of the shell was mixed 1:2:4, with the stone small.

Before the first section of the concrete jacket was applied the old chimney was carefully wrapped with asbestos felt. This served a double purpose, acting first as an expansion joint between the old and new structures, and serving also to protect the green jacket against too rapid drying by the heat of the inner shell, and against the drawing of moisture from the green concrete into the old chimney.

The other aspect of the work, which is of especial practical value, was the ingenious construction and operation of the form used by the Aberthaw Construction Co. on the cylindrical portion of the chimney. The form proper consisted of a cylinder of 16 gage iron, 5 ft. high, with an inside diameter of 5 ft. 8 in. This was made in 3 equal sections divided vertically. The horizontal framing consisted of 3 2 by 2 by 0.25-in. angles rolled to a true circular arc. Each section of the form proper therefore constituted a cylindrical surface of 120 deg. braced horizontally by the curved angle bars, 1 at the top, 1 at the bottom, and 1 midway between.



SECTIONS OF CHIMNEY, JACKET AND CYLINDRICAL IRON FORM WITH STAGING

Extending horizontally from the top of each of these sections was built a platform braced diagonally to the bottom of the form section with 2 by 2 by 0.25-in. angles, and resting on horizontal angle bars running to the upper corners of each section of the form. These 3 sections of form and staging combined were fastened together by bolts running through angle bars on the vertical edges of each section of the form and

through the pairs of adjacent angle iron supports under the platform. The form and the working platform were suspended by heavy ropes from 3 12-in. single blocks, which were themselves hung from a heavy ring set on top of the overhang of the chimney.

The cylindrical portion of the jacket, in which the form was involved, was made in the following manner. The asbestos having been applied over a height of about 5 ft. from the top of the cylindrical form, the form was then raised, and concrete was filled into the space between the form and the chimney and closely tamped about the reinforcing steel. The next forenoon the asbestos and steel were extended farther up the chimney, and the form was hoisted a distance of 4 ft. 10 in., leaving a lap of 2 in. on the concrete placed the day before. The concrete of the second day's work was placed in the afternoon and was allowed to set until the next morning, when the form was again raised 4 ft. 10 in., and a new ring of concrete was placed that afternoon. The form and platform were prepared for hoisting by loosening the bolts in the facing angle bars which formed the 3 joints. This allowed the form to swing a little free of the new concrete and allowed of easy movement.

An interesting feature of the preparatory work was the method by which the steeple-jack reached the top of the chimney. One of the largest cracks in the old structure ran from top to bottom, and this furnished a good place for driving in stout hooks. At the start, the steeple-jack climbed up a ladder resting on the roof of the power house, and reaching up on the chimney drove a stout hook into the big crack. From this hook he then hung a small block carrying a rope. This combination made it possible to hoist a second ladder, which was allowed to lap on the first ladder, to which it was lashed. Climbing to the top of the second ladder, the steeple-jack drove a second hook into the crack in the chimney, reaching up as far as possible. Putting a block and line on this second hook, he was able, after getting down to the power house roof, to raise another ladder, which was lashed to the second ladder. From the top of this third ladder he drove a third hook into the crack, and so extended his track another space upward, and so on. The ladders had hooks at the ends, which held them away from the chimney. They were held firmly in one direction by lashings to the hooks, and the combination was stayed by ropes carried round the chimney every 15 ft. The ladders were taken down by reversing the process of erection.

## HE HAD REASON TO GET MAD

WPETT RIDGE, who won his public in this country several years ago when the Harpers published his novel of a young London girl of the slums entitled, "By Order of the Magistrate," is counted in London, a most excellent story teller. One of his yarns is of an infuriated musician who rushed up to a policeman and demanded vengeance on a small urchin who, he protested, had insulted him:

"I was coming along the road in a hurry just now," he explained, wrathfully, "when the young scoundrel stopped me and asked me the time. I said, 'It is ten to three,' and he said, 'At three o'clock get your hair cut.'"

The policeman glanced slowly at a neighboring clock.

"Well," he replied, stolidly, "you're all right, sir—you have still got a good eight minutes."

## WILKINSON SAFETY WATER TUBE BOILER

CONSULTING engineers and operators of power plants throughout the country will be greatly interested in a new type of safety water-tube boiler recently put on the market by the Oil Well Supply Co. of Pittsburg, Pa., and built at its boiler works department, Oswego, N. Y.

The accompanying illustrations clearly show the several highly commendable features of this boiler, which will be thoroughly appreciated by steam users, especially where impure feed water is used.

Figure 1 illustrates the boiler in front elevation, showing the headers in circular form, and also the layout of the tubes. The peculiar layout of the bottom row

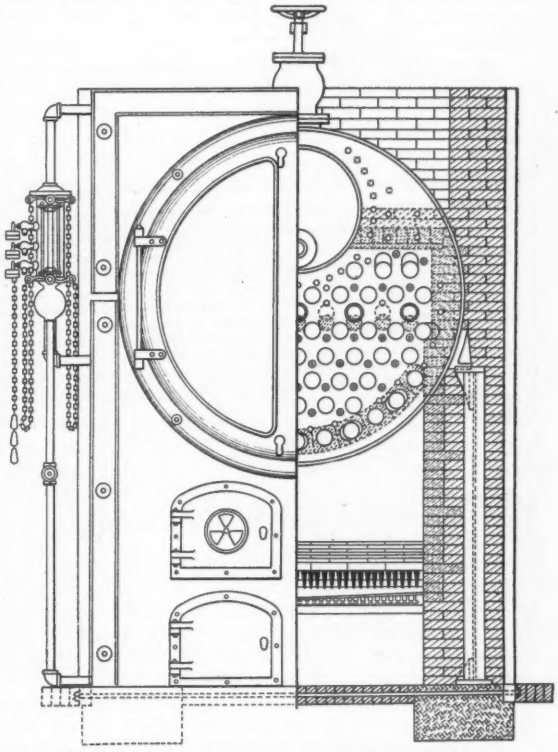


FIG. 1. FRONT ELEVATION OF WILKINSON WATER-TUBE BOILER

of tubes as will be noticed, provides an equal distribution of the products of combustion along the entire length of the tubes, and also permits of a larger area for the combustion of the gases, than would be the case if the tubes were on a horizontal line.

Fig. 2 illustrates the boiler in horizontal sectional elevation, showing clearly the manner in which the inside and outside header sheets are connected together. The sheets are flanged by what is known as the spinning process, and when finished, are pressed one into the other, and then riveted with a single girth seam, the calking edge of which looks outward and can be examined at all times without interfering with the brickwork.

Making the headers in circular form forces all foreign substances to collect at one point at the bottom, and as there are no corners in the construction of these headers for any sediment or scale to lodge, they can be easily cleaned by blowing down.

Another important feature in this boiler, is the manner in which the drum is connected to the inside header sheet, as it will be noticed that the latter is

flanged out to meet the drum shell, thus leaving a clear passage from the drum to the header. In other words, there are no straps or bars used, in connecting the header with the drum, thus allowing a free circulation of the water from the headers to the drum, and consequently free liberation of steam. The inside of both header sheets can be examined and cleaned with a hose by entering the drum through a manhole in the rear head. This feature must commend itself to all power plant operators, especially where impure feed water is used, for when header sheets cannot be examined and thoroughly washed out, scale will form, especially on the inside header sheet, and in time the sheets become overheated and the tubes loosen.

Tube handholes of course could be removed for cleaning out purposes, but this is not only a tedious operation, but a very unsatisfactory one, as a thorough examination cannot be made of the inside sheets even though a number of handholes are removed.

The dry pipe is located well to the front and protected by a system of baffling which makes it impossible for any water to pass over into the separator. The feed is introduced through the front head of the drum through a pipe leading into the settling chamber, the end of which is tapped for surface blowoff, as shown.

The lower row of tubes as will be seen is encased with special locking firebrick, forming the lower baffle, as the water in these tubes being subjected to the hottest part of the fire, would be driven out, owing to the very rapid circulation. These locked baffle brick cannot possibly fall out of place, though easily removable for repairs. The upper baffles are laid on the tubes in the usual manner and passed to either front or rear heads, as shown.

No side cleaning out doors are necessary in this type of boiler, as the tubes can be blown out from both front and rear through hollow stays, each stay taking care of 4 tubes, being made especially for this type of boiler.

These boilers are built in units of from 50 to 500 hp., and for a safe working pressure of from 160 to 250 lb., as may be desired. They are of all-steel construction throughout; no cast iron being used, as the nozzles, handhole plates and guards are made of special semi-cast steel. The tubes being straight can be removed from either front or rear end, and all handhole plates are made fast from the pressure side, and fitted with a special type of asbestos metallic gasket.

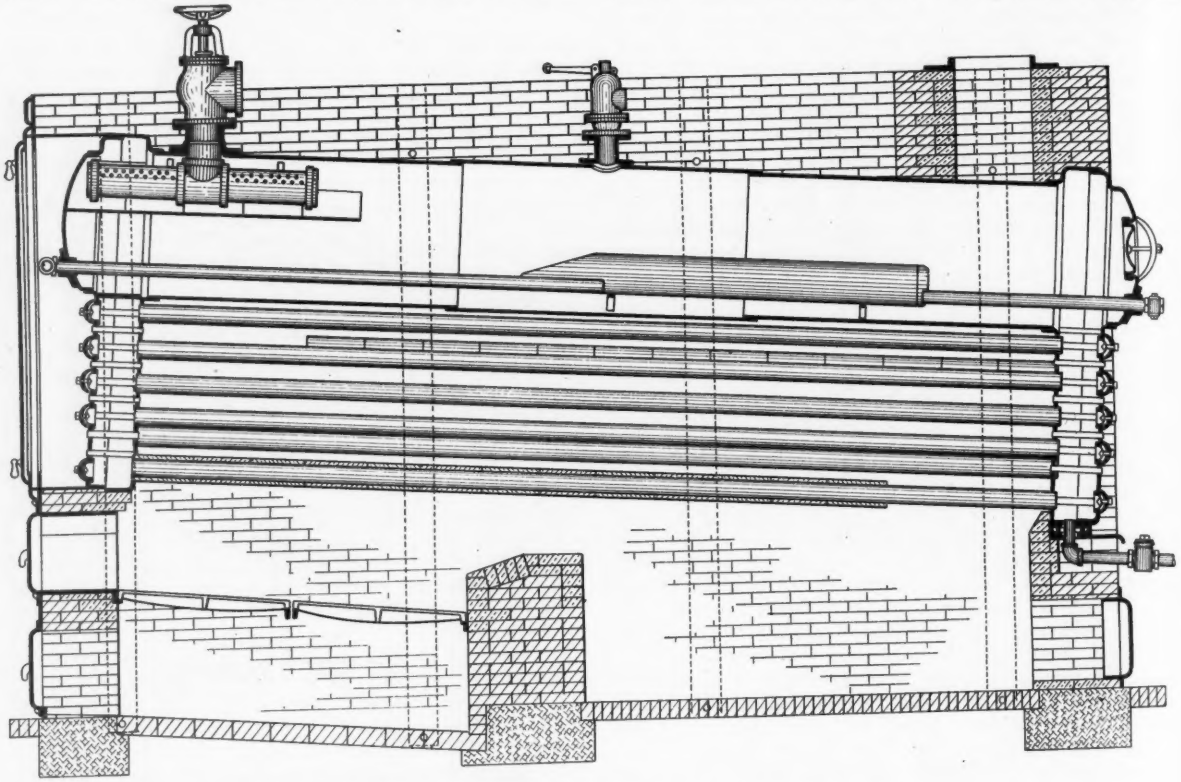


FIG. 2. SECTIONAL HORIZONTAL ELEVATION OF WILKINSON BOILER

They are suspended by a system of steel beams and hangers, which allow the boiler to expand and contract in all directions, without injury to itself or to the brickwork.

All boiler headers in units of 350 hp. and upward, are fitted with double drums, and all units below 350 hp. are fitted with single drums, which are of proper dimensions to give unusually large steam storage capacity.

Exhaustive tests made on several batteries of these boilers, now in operation, show that the steadiness at which the water level is carried, and the dryness of the steam, are remarkable.

Economy in the consumption of fuel is also very pronounced, especially where a low grade of coal is used, and all these essential requirements, coupled with the fact that the cost of this boiler, owing to its design, is reduced to a minimum, make it especially worthy of the careful consideration of all intending purchasers.

---

BOILING CARBON BRUSHES in heavy cylinder oil is said to prevent sparking for a month.

# Questions and Answers

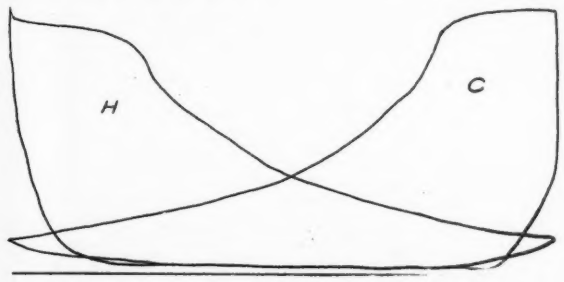
**Ask about your troubles—help the other fellow with his. Give your name and address. For a quick answer enclose stamp for reply.**

### Diluting Lubricating Oil

What chemical or other liquid could I mix with lubricating oil to reduce heat of engine bearings? E. W.

### Indicator Diagram for Criticism

I am enclosing an indicator diagram taken from a 24 by 42-in. Corliss engine, single eccentric, engine running at 75 r. p. m., boiler pressure 110 lb., indicator spring used was 50 lb.




CORLISS ENGINE DIAGRAM FOR CRITICISM

I wish to ask the readers of Practical Engineer what changes I would have to make in the valve gear to get a better diagram. The engine in question runs quiet but I do not like the looks of the diagram and wish to get a better one. Lac.

### Cleaning Charcoal Filter

Can anyone give a method for cleaning the charcoal taken from the filters in an ice plant so as to make it available for use again, or is there any other purpose for which it can be used? C. J.

### Heat Value of Coal

1. What is the heat value of 1 lb. of coal, which contains 65 per cent carbon and 4 per cent hydrogen? How do you find it?

2. A steam plant shows a boiler efficiency of 62 per cent using 1100 lb. of Ill. block coal of 10,000 B. t. u. value per hour. If the engine indicates 250 hp. what is the efficiency of the engine? How do you find it? J. P. F.

A. The expression usually used for calculating the heat in a pound of coal is, as follows: Multiply the per cent of carbon by 14,650, from the per cent of hydrogen abstract ⅛ the per cent of oxygen and multiply the remainder by 62,100. The sum of the 2 results thus obtained will be the heat value.

In your case, 14,650 times 0.65 equals 9,520. Since you give no oxygen, the total hydrogen would be used, 62,100 times 0.04 equals 2484. The sum of these 2 products is 12,004.

2. The heat contained in your coal would be 10,000 times 1100 or 11,000,000 B. t. u. per hour. At 62 per cent efficiency of the boiler plant, this would mean 6,820,000 B. t. u. delivered by the engine. The horsepower is equivalent to 33,000 foot pounds of work every minute or in an hour, it will be 60 times this 1,980,000.

A heat unit equals 778 foot pounds. Dividing 1,980,000 by 778, we get 2545 heat units per hour as the equivalent of one horsepower. Multiplying this by 250 gives us 636,500 thermal units as the equivalent of the energy furnished each hour by the engine. Dividing this by 6,820,000, the heat furnished to the engine gives .0933 or 9.33 per cent as the efficiency of the engine.

### Noisy Gears

I am having trouble with a pump of the Dean make. It is a 3-cylinder pump, connected to an Atlas engine. The pump has been installed about 6 months and the gear makes so much noise that we can hardly stay in the engine room; the noise is not steady, the gears will run along for a revolution on 2 very quietly, then all at once they will sound like they are going to pieces.

The pump runs at 28 r. p. m., pumping against a pressure of 125 lb. a sq. in.; main bearings are 10-in. by 11-in.; pinion bearings 5 by 12 in. The gear wheel is 9 ft. 10 in. pitch diameter, the pinion 17 in. pitch diameter, length of cylinder stroke 18-in., pistons 15-in. diameter, gear ration 6.95 to 1, wrist pin is 3.5 in. in diameter; there are 8 spokes in the wheel 8 in. wide and 3.5 in. thick; the engine shaft runs 219 r. p. m. All bearings are babbitted and the pump came with all cast-steel connecting rods, but these have been broken and replaced by forged rods. The pump delivers 2250 gal. a minute. G. W. D.

A. Evidently your gearing is so arranged that there is an uneven number of teeth, either in the gear or in the pinion, the arrangement being called the "hunting" teeth, so that the same teeth do not always mesh together. Apparently part of the big gear meshes quietly with the pinion, while there is part of it in which the teeth do not match each other. If the trouble is in the gears, this must be what is the cause.

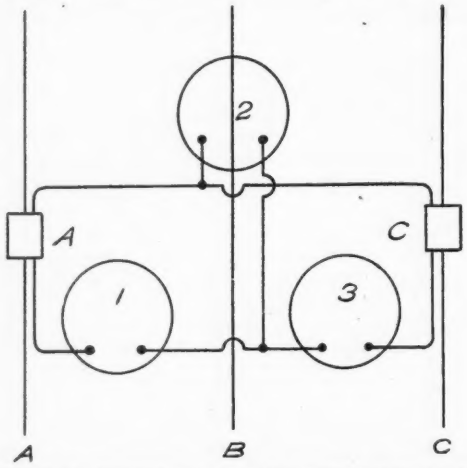
The only remedy is to get a rawhide pinion to go on the engine shaft, thus avoiding the noise.

Another possible location of the cause of the trouble may be in the suction or discharge valves. It is possible that these stick open or slip so that the load on the pump varies. In this case a thorough going over of the valves would be the remedy. If this is so, the engine would probably show it, as the load on the engine would vary widely and there would be some tendency for the engine to race. We would like to know the opinions of our readers who have had experience similar to this.

### Ammeter Connections

How do you get the correct readings from the ammeters of a 3-phase alternating current machine? Also explain how the 2 current transformers work on the 3 ammeters connected as in the diagram. M. E.

A. Ammeter I is, of course, connected to the current transformer A through ammeter 2, so that No. 1 measures the current in line A, likewise No. 3 measures the current in line C. The current that passes through No. 2 will be compounded of the currents




CURRENT TRANSFORMER AND AMMETER CONNECTIONS.

through 1 and through 3, and, therefore, will be the vector sum of these 2 currents, or the current which is flowing in line B.

You have, therefore, the 3 currents in the 3 different wires measured by these ammeters as connected, and if you have the voltages also and the power factor you can compute the power in the circuit. You cannot compute this power, however, without knowing the power factor.

### Miscellaneous Power Plant Questions

1. Should return tubular boilers of different diameters be set so their water level or grate bars be on a common level when set in a battery where gravity returns are used?

2. Explain the operation of an air injector used on hydraulic elevator systems.

3. Why are not duplex pumps without walking beams used for air pumps?

4. How can you tell whether an injector or pump suction pipe is stopped up or has an air leak, if the pipe is out of sight?

5. How is the main shaft of a vertical engine lined sideways as well as level?

6. Why are crank pins longer than wrist pins?

7. Why is a piston rod usually smaller where it enters crosshead?

8. When is a pump "steam bound?" W. F. M.

A. Boilers of different diameters which are to be run in battery would better be set with the water level on a common height, although this is not essential, and if it will cause serious inconvenience in the firing it may be better to bring the grates to a common level.

When running boilers with a common steam connection, of course, there is no connection between the water spaces so that the height of the water in the different boilers may be entirely different without causing any trouble unless there is leakage from boiler to boiler through the blowoff pipes, which ought not to be the case. The use of gravity returns makes no difference, as water must be pumped from the receiving tank into the boilers, in any case, and the amount of feed to each boiler can be regulated by the opening of the feed valve.

2. Probably what you mean by an air injector is some kind of an aspirator apparatus used to force air into the pressure tank above the water so as to give an air cushion at this point. Generally, however, an air compressing pump of some sort is used, such as is made for air brake systems on railway trains.

3. Duplex pumps without walking beams are often used for air pumps; in fact, more often than with them. There are 1 or 2 makers who use the walking beam because they believe it makes a more even running pump and others think there is no need for it.

4. If the suction pipe of an injector were stopped up it would be impossible to get any water to come up to the injector at all, whereas if there were an air leak the water could probably be started through the overflow, but the injector would break as soon as you attempted to make it force into the boiler. In the case of a pump, if the suction pipe were stopped, the pump would, of course, get no water to work on, but it would, nevertheless, pull on the vacuum maintained in the suction pipe, whereas, if there were a considerable air leak in the suction pipe it would get no pull at all and would simply slam back and forth without load.

5. In lining the shaft of a vertical engine it does not make so much difference whether it is exactly level with the earth's surface or not, provided it is at right angles to the center lines of the cylinders. You must get, as in the case of a horizontal engine, first of all a line exactly through the center of the cylinder. Then the shaft must be lined up so that it will be exactly at right angles to this line horizontally, and must be parallel to the line through the centers of the cylinders, if there are more than one, vertically.

If it is a single cylinder vertical engine, the shaft will be lined up the same as in a horizontal, by turning the crank first to one side of the cylinder and then to the opposite side, and making sure that in both cases the line through the center of the cylinder passes exactly at the middle of the length of the crank pin.

6. Crank pins are larger than wrist pins because the crank pin has to carry the pressure due to the steam in the cylinder, while the wrist pin simply has to carry the force necessary to move the valves.

7. As a usual thing the piston rod is turned down where it enters the crosshead, either to a shoulder or else on a taper, simply for convenience in making mechanical joints. This can be done since there is no tendency in the part that is gripped in the crosshead to bend sideways, as is the case at other parts of the rod.

8. A pump is steam-bound when in trying to pump hot water the water cylinder becomes filled with steam, or partly with water and partly with steam, at such a temperature that the pump in running loses its suction and simply runs back and forth with the steam in the cylinder expanding and being compressed.

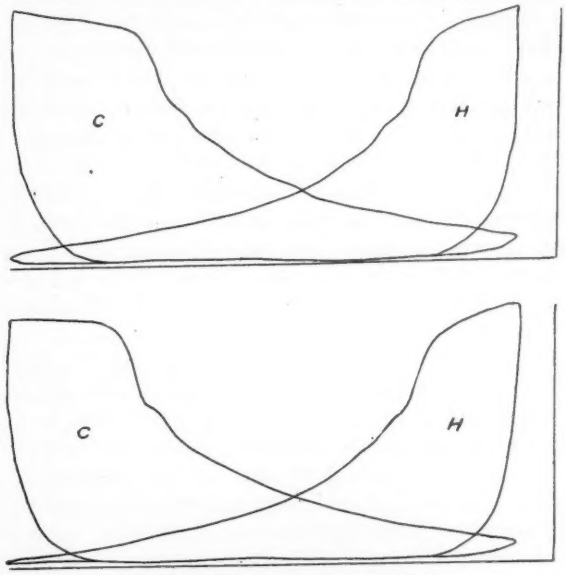
### Why the Pound?

Kindly examine the enclosed indicator cards and point out all faults or errors in valve movement. The engine is large for the job and when running with all switches out makes a very unpleasant noise at the head end valve which entirely stops when the load is put on. It also has a pound at the main bearing: it

appears to take place just as it goes over the center, both head end and crank end. It warms up at the main bearing but the crank pin runs cold, so does the pillow block. F. H. F.

A. A pound usually comes from lost motion somewhere, but sometimes a noise which appears to be in the bearing is really in the crank pin. From what you say about the action in the main bearing, it would seem as if that might be a little out of line, probably low or to one side. It is not likely to be high.

The cards are fairly good but carry a higher compression than is common on Corliss engines. This may




CARDS FROM A CORLISS ENGINE

be necessary because you are running at a rather high speed, but I suspect a somewhat smaller compression would give you a little better steam economy. On the crank end the release is a trifle late, but not enough to produce any serious results one way or another. Apparently admission at the head end is a little late and the valve seems to throttle the steam during admission more than it should.

On a Corliss engine with a sufficiently wide valve opening, the steam line during admission ought to be very nearly horizontal, as is the case on the crank end card. It may be that this is due to late admission or it may be that the valve is not opening as wide as it should.

On all the cards a funny little jump appears about one-third the way down on the expansion line. As this is the same practically in all the cards, it seems to show that the indicator piston is sticking at this point when it drops. It does not seem likely that there would be anything in the steam action which would cause this peculiar break on both ends of the cylinder just at that particular time.

### Changing Frequency of Electric System

1. We are about to change the frequency of our electric lighting plant from 133 cycles to 60. Will you tell me just what our transformers will do, as they are all wound for 133 cycles? The voltage will be the same, so I thought we could keep the transformers we have in service, on light load, for this coming summer, and change them one at a time.

2. We also have a number of motors in the same fix; will the change of frequency change the speed of these motors, or just the efficiency?

3. What is the best way to balance the load on a 3-phase generator, most all lighting load? F. J. R.

A. Your transformers will work all right only that they will take a considerably larger magnetizing current with the lower frequency. This means that they will work with a lower efficiency but otherwise there will be no harm.

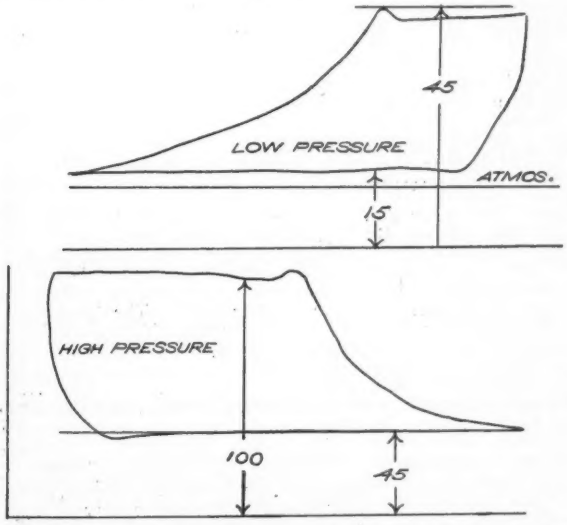
2. If the motors are synchronous motors, change in the frequency will, of course, change the speed. If they are induction motors the change in frequency will change the speed and efficiency. The speed will be about half on 60 cycles what it is at 133 cycles.

3. In regard to balancing the load on the 3-phase generators, the only thing that you can do is to watch the ammeters on the 3 legs. The legs which show up with heavy load will then have to have some of the lights changed over and put on the legs which show under-load. It is a matter of switching about until the desired balance is obtained.

### Air Compressor Diagrams

In a 25 by 18 by 18 compound air compressor, motor driven, the low-pressure cylinder compressing up to 30 lb. and the high-pressure to 85 lb., what would be the approximate shape of the indicator cards? Would this be on the order of a pump card? N. V. T.

A. The card will not be similar to a pump card because while you draw in air at atmospheric pressure,




LOW AND HIGH PRESSURE CARDS FROM A COMPOUND AIR COMPRESSOR

when you begin to compress it you have first to raise it to the discharge pressure before any of it is forced out of the cylinder. This would mean that in your case the low-pressure cylinder compresses from 15 lb. up to 45 lb. absolute, and the high-pressure from 45 lb. up to 100 lb. absolute. The cards would then be somewhat as indicated.

"ELEKTRON METAL" is the name given to a new series of alloys, chiefly magnesium, whose weight is 50 per cent less than that of aluminum alloys and strength and tenacity greater. In cast form the strength is 25,000 lb. per sq. in., and when rolled and drawn it rises to 50,000 lb. per sq. in.

# PRACTICAL ENGINEER

PUBLISHED ON THE FIRST OF EACH MONTH
at 355 Dearborn Street, Chicago, Ill., by the
TECHNICAL PUBLISHING CO.

NEW YORK, 150 Nassau Street. PHILADELPHIA, The Bourse.

Subscription Price One Dollar a year in advance to any Post Office in the United States and Mexico or United States possessions.

To Canada One Dollar and Fifty Cents; to Other Countries Two Dollars a year. Single copies 10 cents.

Address all letters and make all checks and money orders payable to Technical Publishing Co., 355 Dearborn Street, Chicago, Ill. Notify us at once of any change of address, giving the old and the new address, so that your paper may always reach you promptly.

Any advertiser is invited to examine our paid subscription lists and Post Office mailing receipts at any time.

Entered as second class matter May 1, 1908, at the Post Office at Chicago, Illinois, under the Act of March 3, 1879.

Circulation of this issue, 19,500.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## MORE ENERGY FOR LESS MONEY

When the power plant for the New York Subway was built, it was thought that it was big enough for all time; then the traffic began to grow, and the power soon became too small.

The big reciprocating engines which are the best type that has been devised for large units, were doing splendidly, but they were compounds and had the common trouble of that type that the economical range was limited, and on variable load such as comes to a street railway, the water rate was uncertain.

Hitching a low-pressure turbine to the exhaust of a non-condensing engine has become well established practice, under the proper conditions, but to put a turbine on the end of a compound condensing unit was a new scheme. But room was scarce and the high-pressure turbine unit could not show on paper as good efficiency as the combination of engine and turbine. An increase of 100 per cent in the power of the plant and an efficiency greater than that of any other type of steam plant decided the management to try the plan, and a 7500-kw. turbine unit was ordered. Tests have shown the result.

The generating unit has its power doubled; 85 per cent of the condensed steam is available for boiler feed; commercial efficiency is 13 per cent better than for the best high-pressure turbine plant; steam consumption is reduced 25 per cent from that for the engine unit alone; the thermal efficiency is raised to 20.6 per cent between the limits of 6500 and 15,500 kw. The total combined economic efficiency is 146 per cent in advance of the former arrangement.

This record is one to give food for thought to all who are interested in the design or enlargement of any plant. We have known that the turbine was to be considered as a complete unit or as an addition to a noncondensing engine in making any plans, but this departure would seem to establish the turbine as a necessary adjunct to every reciprocating plant where the steam is not used for heating or industrial purposes. The case of the low-pressure turbine seems to be proven, not only because it increases the power of the plant and might therefore be adopted when a plant gets too small for the work, but also because it increases the thermal efficiency of the plant beyond that possible with any other arrangement and also removes one of the difficulties of the compound engine on variable load—the limited range of good steam economy.

It is as we have felt ever since the advent of the turbine, not a case of battle between the 2 types of prime movers, but one of co-operation which will be the final situation, and by the alliance, the threatened conquest of the power field by the invading gas engine is deferred and limited even if not averted.

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FISHING BY ELECTRICAL POWER is a new application of the "juice." From a trolley line along the White River, near Columbus, Ind., the fishermen have tapped current by a wire the end of which is dropped into the water.

## OFF DUTY

CAN anybody ever be off duty? Well, we don't have to work all the time, but then we are always on the watch to see the things that will help when we are at work, that is, if we are the right sort and are looking to do the best for ourselves and for the world which gives us a chance to live.

You who are now actually keeping the wheels turning, and we who are digging out knowledge to bring to you which will help make the wheels run smoother are always looking and listening for the things which will help along. But with this all, there must be times which we give to those thoughts which make for better living as well as better working, for bigger manhood and livelier citizenship. And after all, are not these things as important as the others in getting to do work well? Do we not need to get in touch with our fellow men in other lines and what they are doing if we are to have all the facts that will help in our own work? Do we not need to understand what part our work has in the work of the world if we are to do it intelligently and gladly?

A fireman who simply shovels coal into the furnace without an idea of why the boiler is being run, an engineer who turns steam on and off without knowing for what the power is to be used and the needs of the plant, an electrician who pulls switches and cuts in dynamos with no thought of the load that he is to carry and no knowledge of the effect of different motor loads on his plant,—all these are falling far short of being efficient in their respective lines.

And are they much more efficient in the community if they are content to know only the things which apply to the boiler room, the factory or the central station with no thought of the big things that are happening in the fields of science, art, politics, literature, commerce—all the multitude of lines that make up present day activity?

All this by way of saying that we feel that our readers are men as well as engineers and think that they will be interested in some of the things that are going on outside as well as inside the power plants. Which is a reason for bringing to these pages some of the interesting facts and fancies that come within the view of the editors while they are "off duty"—that is, not on watch with full steam up to turn out copy for the next issue. Off duty notes from readers will be welcome, too, and will be used so far as we can judge that they will be of interest to a large number of readers.

### Such Big Things and Such Little Ones

Will the comet hit us? There have been all sorts of scare headlines and articles in the papers and magazines lately about the fiery wanderer, Halley's Comet, which is due to wrap its filmy tail around the earth during the month of May. If this blessed warm spring weather is due to the comet, we say, "Come on! Curl that tail right around us tight and hang on, only please unwrap it before the August leaf of the calendar comes to the top."

Well, the latest report from the astronomers, who make such matters a business, and know the whereabouts and the why of the stars as you and I do those of the valves and pipes in our plants, is that the head of the comet will be (now watch the ciphers) 15,000,000 miles away at its nearest point, and that it is only a bunch of hot gas anyway, so that our steady old earth will not be attracted by it enough to lean that way or even to hesitate in its course.

Pofessor Pickering of Harvard estimates that the chance of the earth being hit by a comet is about once in 50,000,000 yr., and then only by the outer envelope of the head, not by the real head of the comet. Of course, we get into the tail of the procession sometimes; in fact, the earth has passed through the tails of comets twice in the memory of men now living, and nothing special happened. The last time was in 1861 so that if there had been any unusual disturbances they would have been noted in the papers of the time.

What impresses us is not the possible trouble from the comet, which seems rather remote, but the keenness of the minds that are able to estimate these things, and tell us even with the possible error that is involved, when and where we shall be and where the other apparently irresponsible members of the Universe will be at any given time. Of course there may be an error of a million miles or so in the calculations, but that isn't so bad when you stop to consider that the earth and the entire Solar System are traveling through space at the rate of 400,000,000 miles a year, so that a million miles is only a day's run for the system.

And we here on this little globe only 8000 miles through think that we are the whole object for which the universe was created.

Then these astronomer folk get out their telescope instruments and such and start in to weigh the earth; and they get a result that in pounds is 13 with 24 ciphers after it. Write that down and try to read it if you want some mental gymnastics. And this is pretty accurate too; for they had it first 5.5 times the weight of the same volume of water; then they got it to 5.527, and now they have checked up until it is put at 5.493 times the same volume of water. It takes some patience and some figuring to split hairs like that on a load as big as the earth.

But talk about splitting hairs—take notice of Sir William Ramsay experimenting with radium. He gets from the Austrian government a speck something less than the size of the point of the finest needle (worth $45,000), and starts to find out all its family secrets. He weighs it to get the specific gravity; he finds its boiling point and its freezing point; he finds what it looks like when it is a liquid and when it is a solid; he finds at what rate it gives off energy and gases and how long it will last; he finds that it goes on changing into other things and classifies 6 different kinds, tells us what some of them look like and how long they will last, some 30 min. and some 40 yr.; and he finds what kind of different energy rays the different substances

send out, what these rays will do, how fast they travel, and the energy that they carry.

Which is the more wonderful measurement?

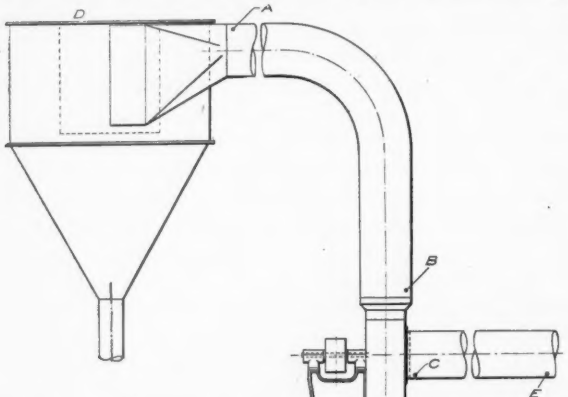
Even on these ultra-minute observations, the figures run big. Not only is the cost of the radium large, but it takes 1750 yr. for it to lose half its substance, and forever for it to disappear entirely. The oxyhydrogen blowpipe is hot, but radium gives off 3,500,000 times as much energy. And the rays given off travel at 40,000 miles a second. Even that little mote of rare earth isn't so slow as to be left in the race with the comet.

What's the use? For one thing the whole world isn't neglecting its business in fear of the comet as was the case in the dark ages when it wasn't understood. For another, we begin to get some idea of the grandeur of the universe and its Creator. And we are getting nearer all the time to knowing the relation of the different forms of energy and to controlling and changing them at our will. Nobody can tell where the seemingly useless facts of to-day will be applied to-morrow. Galvani's twitching frog legs and Franklin's lightning-catching kite have led to the 500-mile, 150,000-volt transmission line for electric current. In another hundred years our present methods of getting and using energy may seem as crude as the old style overshot waterwheel and the tallow dip seem to us.

And, to justify this " off duty" departure, isn't it worth while to keep in touch with these things which spell progress for the world and mankind, even for their own sake?

## CYCLONE DEFECTS

IN MANY plants where blowers are used for the removal of shavings, dust and other refuse, a Cyclone Head is installed under an arrangement shown approximately by the illustration. It has come to our attention that in many such installations, due to lack of area in the Cyclone or the piping, a heavy back




CYCLONE SYSTEM AND POSITIONS FOR TEST MEASUREMENTS

pressure is put on the fan, thus wasting power and causing bad operation of the system. We believe that engineers who have such a system in charge will be glad to know whether their systems are designed and working correctly or not and, therefore, make the following proposition to our subscribers:

If you will make the measurements of draft or pressure in your system, as shown on the illustration, at the various points, A, B, C, E, we will furnish you without cost a special design of U tube for this purpose. This tube has a metal back and a rubber connecting tube and is the most convenient device for taking draft pressures that we have seen. The instrument will be sent you at no cost whatever to remain your property. The only requirement is that you agree to take readings with the instrument at the points indicated, and send us the figures and approximate dimensions of your system. We will then tell you whether your system is correctly installed or not, and, if not, what changes are necessary to put it in proper condition for the best operation. This is an opportunity for you not only to get a fine piece of convenient apparatus but to improve your plant in a vital point, to save power and decrease coal bills. If you wish to take up this matter simply write to Practical Engineer, Cyclone Department, Chicago, Ill., giving your name and address, and the name of the plant of which you have charge, and we will attend to the rest.

## CHARLES F. AARON

CHARLES F. AARON, general manager of the New York Leather Belting Company, died at his home in Plainfield, N. J., on March 4th, following an operation for hernia. Mr. Aaron was one of the best known belting manufacturers in the United States.

For many years he had been closely identified with the largest machinery and supply manufacturing interests of the United States, and from its organization was prominently identified with the American Supply and Machinery Manufacturers' Association. He was president of this association from May, 1908, to May, 1909, and prior to that time had for several years been the vice president and chairman of its executive committee.

Mr. Aaron is best known for his work in this association and outside of it in connection with his efforts for higher standards of production among American manufacturers.

It was largely his inspiration and suggestion that prompted the American Supply and Machinery Manufacturers' Association in convention at Pittsburg last May to adopt what was known as its Declaration of Principles. This document, which was unanimously adopted, put all members of that association on record as pledging themselves and their factories to higher qualities in the goods they produced, and it condemned the practice of substituting inferior goods as first qualities. The document referred to caused much discussion and favorable comment in the daily and trade press of this country as well as abroad as being an advance step among American manufacturers for better goods and fitting condemnation of the manufacturer of low grade products.

Mr. Aaron is perhaps even better known in connection with a campaign he was making up to the time of his death for raising to a higher plane the standards of manufacture of leather belting. He was promoting a plan for general adoption by belting manufacturers of standardizing the specifications upon which all leather belting of first quality should be built. His plan entailed the national adoption, by all manufacturers, dealers and consumers, of rigid belting specifications, a national stamp or trade mark which should go upon all such goods by whoever manufactured, and a severe penalty to the manufacturer who put out supposedly first quality goods bearing this stamp, which did not fulfill specifications.

Several of the largest of the supply dealers' associations now have his plan under advisement of com-

mittees, who will report upon it in connection with like reforms in other lines at conventions to be held this spring.

Mr. Aaron's influence and work in behalf of higher standards of manufacture, not only in his own line but in all machinery lines, will be felt for many years.

Mr. Aaron was known personally by the heads of thousands of American manufacturing plants. He was a man who brought himself to the front among American manufacturers by sheer hard work. He started at the very bottom of the ladder, spending several years in the leather belting factory of his father, mastering every technical detail as to the methods of manufacturing followed by his company. Following his apprenticeship in the factory, he made suggestions for the improvement of qualities in the belting put out by his concern.

He also was author of the first book ever published in this country describing the whole system of manufacturing leather belting from the time the hide was taken from the steer until it was ready for installation on pulleys. This book is used in several colleges as an authority on the most improved method of manufacturing leather belting.

Mr. Aaron was prominently connected with the Masonic Order, was a Knight Templar, and a Shriner, belonging to Kismet Temple, A. A. O. N. M. S. He was also well known as a member of the Elks, was a member of the Machinery Club, and the Crescent Athletic Club of Brooklyn. He was 43 yr. old at the time of his death and leaves a wife and 3 children.

## JAMES H. BLESSING

ON FEB. 21 James H. Blessing, ex-mayor of Albany, N. Y., died at his home in that city. Mr. Blessing was elected mayor of Albany in 1899 by a majority of 3,369 and he served out his term with admirable success and would undoubtedly have been re-elected had he not, 6 mo. before his term expired, announced that on account of his business and his health he would not again be a candidate. The latter years of his life were devoted mainly to his home and his business, his being the president and one of the 2 owners of the Albany Steam Trap Co.

The other owner is Thomas F. Ryan, secretary and treasurer. Mr. Ryan was associated with Mr. Blessing for 26 yr., serving in the capacity of machinist, engineer, foreman, superintendent and finally secretary and treasurer of the company. He is thoroughly familiar and conversant with all phases of the business and it will be continued under his management.

Mr. Blessing was known as a man of sterling integrity, possessing an upright character and actuated by the noblest purposes. One of his chief characteristics was that he stood firmly for what he believed to be right under all circumstances.

He was born at French's Mills, near Sloan's, in Albany county, in 1837. When he was about 5 yr. of age his parents moved to Albany. He attended the public schools until he was 12 yr. old, when he secured a position as a clerk in a grocery store. In 1853 he was apprenticed to learn the machinist trade with the then well known firm of F. & T. Townsend. His apprenticeship was completed in 1857, and he remained with that firm until 1861, during which time he, with the late Frederick Townsend, invented a breech-loading rifle intended for army use.

When the Rebellion broke out, Mr. Blessing entered the United States navy, as an acting assistant engineer. After the war and until 1866, he was an engineer in charge of the steam machinery of the Brooklyn City Railroad Co. He returned to Albany in 1866 to act as superintendent for Townsend & Jackson's foundry and machine works, successors to the firm with which he served his apprenticeship.

In the year 1870 Mr. Blessing invented the return steam trap, which has become well known, and is used generally in nearly all parts of the globe. Leaving the employ of Townsend & Jackson in 1872, he engaged in the business of manufacturing and selling steam traps, under the firm name of Townsend & Blessing.

This business proved successful, and in 1875 the Albany Steam Trap Co. was formed with 3 stockholders, the late General Frederick Townsend, the late Henry H. Martin and Mr. Blessing.

Mr. Blessing's mechanical training had developed and developed many novel and useful inventions, among them steam engines, steam traps, steam pumps, steam boilers, steam valves, steam packing, pump governors, steam and oil separators, friction clutches, water filters, boiler purifiers and many others.

Mr. Blessing was a member of the American Society of Mechanical Engineers, also of the Albany institute.

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AT THE FEBRUARY MEETING of the Technical Publicity Association in New York, "Catalogs" and the experience of members with them was the subject discussed. The relation of the catalog to an advertising campaign was the keynote and the value of impressing the reader as well as giving him information about goods and prices was emphasized. Essentials of a catalog were enumerated as, clearness, standard size, lettering on the back if over 0.25 in. thick, good titles to cuts, perspective cuts where possible, simplicity and attractiveness.

A uniform advertising contract was adopted and a number of new members admitted.

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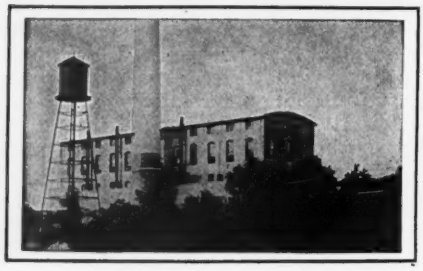
A 30,000-TON BATTLESHIP is talked of for the United States Navy as a result of successful tests of the new 14-in. gun at Sandy Hook. Such a ship would be intended to mount 12 of these guns, but has not yet been shown adequate to the task. For 12 12-in. guns the displacement used is about 22,000 tons.



# Power Apparatus

## In Shop and Market

**New Ideas in Making, Buying and Selling**

### TACKS

**A Pointed Sermon on Salesmanship**

HE WAS one of those What-can-I-do-for-you-to-day-Mr. Jones? salesmen and he stood leaning against the counter in a hardware store in an Indiana village. From the expression on the young fellow's face it was evident that he couldn't do anything for Mr. Jones.

"No," said Mr. Jones, "I won't order anything to-day. The fact is I don't know just what I want 'til I look over my stock. If you happen to be around in a few weeks I may need something in your line."

"Well now, Mr. Jones, I'd like to have you give my house a little order, sort of a trial order to acquaint you with our goods. Can't you think of something you're low on? We keep almost everything in the hardware line from a nail to a harvesting machine."

"No," said Mr. Jones, "I can't think of a thing."

The salesman looked dejected. Just then a girl came hurrying into the store. She started to speak but stopped short. "I've forgotten," she murmured to herself. Then she said:

"Mother sent me after something, and I don't know what it is."

"I do," said Mr. Jones, quick as a flash.

"What?" asked the girl, with mingled surprise and curiosity.

"Tacks," said Mr. Jones.

"Why, yes?" exclaimed the girl. "We were laying carpet and ran out of tacks. Mother sent me after 3 boxes."

She took the tacks and hurried home.

"How did you know that?" asked the young salesman after she had gone out.

"I didn't," replied the merchant. "She thinks I did, but I didn't. I knew it was housecleaning time and people had their carpets up. When she came hurrying in with that old apron on it just struck me that she might be laying carpet."

The young salesman straightened up. He wore a new look—a look of determination. He picked up his grips.

"Good-day, Mr. Jones," he said as he held out his hand; "I won't come back here to take your order."

He hurried out.

"Wonder what's the matter with him?" murmured Mr. Jones as the fellow hurried around the corner. "What did he mean by that? I didn't do anything to make him sore."

* * * * * * * *

A few weeks later, one bright morning, Mr. Jones was reading a newspaper.

"Aha! Good morning, Mr. Jones," called a cheery voice.

Mr. Jones looked up. It was the young salesman.

"Good morning," he grunted.

"You're feeling well this morning, Mr. Jones?"

Mr. Jones suddenly realized that he was feeling unusually well.

"Yes," he replied.

"Now, Mr. Jones," continued the young man before Mr. Jones could say anything, "you're out of padlocks. We are selling an improved six-lever padlock that's a beaut. And we are giving 4 keys with each lock. That feature alone is worth considerable to you as a selling point. Just look the lock over. You see it is plain and substantial. Got a regular bull-dog grip when it's locked. Such a convenient size, too," he announced, slipping it easily into his vest pocket and drawing it out again. "Looks well any place," he continued, hooking it into the staple of the latch on a nice oak chest that happened to be sitting on the counter.

Mr. Jones was impressed—to the extent of 4 dozen locks. And that was only the beginning.

About noon Mrs. Jones stepped into the store. There was no one in sight, but she could hear the sound of voices from the attic above the store.

"Come to dinner, John," she called.

Mr. Jones descended the steep flight of stairs leading to the attic. Following him was a very dusty and begrimed young salesman in his shirt sleeves, carrying a pad and a pencil.

"Mr. Franks," said Mr. Jones, "this is my wife."

"Very happy to make your acquintance, Mrs. Jones," said Mr. Franks, smiling through a layer of dust.

"Sarah," said Mr. Jones, "Mr. Franks and I have sort of been looking over the stock this morning to see what I need for the winter. Can't you give us both some dinner so that we can get right back to work after dinner? It will take a good while for Mr. Franks to go over to the hotel for dinner."

Mrs. Jones would be delighted to have Mr. Franks come to dinner. No trouble at all.

Yes, he would be pleased to do so if they would excuse his appearance.

"Say," asked Mr. Jones, as they sat at dinner, "how did you know I was out of padlocks?"

Mr. Franks smiled. "I didn't," he said. "You thought I did, but I didn't. I just guessed. You see it was this way: Your window floor is covered with black cloth. Black cloth shows the dust very plainly. Consequently, when you take anything out of the window, the spot that it has covered shows up very plainly in contrast with the part that has been exposed to the dust. As I walked into the store this morning I noticed a spot with the outlines of a padlock and I figured that someone had come in to buy a padlock and you had none in stock, so you took the one in the window."

"You're right, by George! Bill Short came in after one day before yesterday and I had to take that one 'cause I didn't have any other. Was going to order some today. Say, young man, you're a clever salesman, aren't you?"

"I learned it all from you, sir," said Franks. "Don't you recall that box of tacks that you sold to the girl

that day? That was my first lesson in salesmanship. I've been practising it ever since."

Mr. Jones looked surprised. "Well I'll be blowed," he ejaculated.

"By-the-way," said Mr. Jones late that afternoon as Franks was putting on his coat to leave, "I thought you said that afternoon that you weren't coming back here to take my order."

"So I did," replied Franks. "I decided that afternoon when I saw you sell those tacks that when I came again it would be to sell goods—not to take orders. I'm through being an order-taking salesman. Now I sell goods."

"Gee! I guess he does," mused Mr. Jones an hour later as he looked over the three sheets of order blanks filled in solid with goods that he had ordered that day.

And "the office" smiled when the salesman sent the order in the next day. Furthermore, the smile of "the office" broadened until it developed into this letter to the salesman:

"Effective immediately: Your salary will be increased $500 per year."

Moral: Sometimes there are sermons even in carpet tacks—and they're right to the point, too.—Advertising & Selling.

## OHIO BLOWER CO.'S NEW FACTORY SITE

THE Ohio Blower Co. has just purchased a parcel of land, approximately 2.5 acres, from the Schofield estate in Cleveland. This property is located in the center of the manufacturing district of the East Side, being just east of 55th Street and north of the Erie Railroad Station. The site is ideal for a manufacturing property, being accessible to both the Erie and Pennsylvania Railroads. The company proposes to start building within the year, and the plans are to build a factory building of the latest type with every modern advantage.

Business of the company has grown to such proportions that its present quarters are inadequate and this made necessary a factory of much larger proportions. The products manufactured by the company are automobile sheet metal parts, such as hoods, fenders, tanks, under-bonnets, etc., "Swartwout" cast-iron exhaust heads, steam and oil separators, ventilators, automatic safety water gages and gage cocks. In addition it designs, manufactures and installs modern dust collecting systems and supplies mechanical heating and ventilation in factories and other large buildings.

The Ohio Blower Co. is an Ohio corporation of $50,000 capitalization, organized a little over 8 yr. ago by D. K. and J. D. Swartwout and associates. They commenced business in a modest way on the second floor of the building corner of Seneca and Michigan streets, occuying about 3,500 sq. ft. A year later they were forced to take larger quarters at what is now 330 Prospect avenue, N. W. Two years later they were again obliged to lease the building next to them to accommodate their growing needs, and now have to go out again for more room.

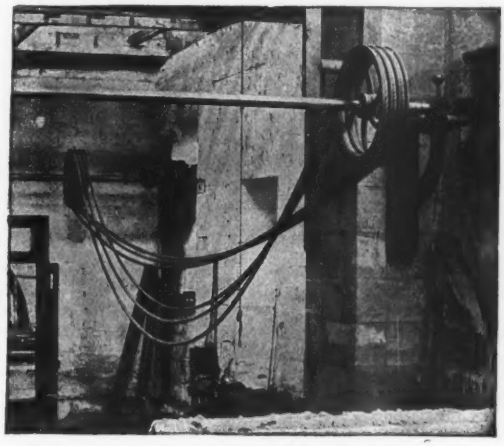
The present active organization consists of D. K. Swartwout, president and treasurer; J. D. Swartwout, Saginaw, Mich., vice-president; H. H. Lind, secretary; W. J. Foster, superintendent; W. L. Ryan, cashier.

THE JOURNAL OF ELECTRICITY, POWER & GAS, published in San Francisco, has opened eastern offices at 150 Nassau street, New York, in charge of C. N. Manfred, who was advertising manager of the H. W. Johns-Manville Co. for 5 yr. past.

## AN AUSTRALIAN ROPE DRIVE

THE rope drive installed in the Paramatta Woolen Mills, Sydney, N. S. W., as shown in the picture is rather odd in several ways. The 3 ropes are independent of each other (English System) and have stretched to such lengths that their slack parts sag far below and run in between the driving halves. The ropes run well in spite of contact with each other, and although such an arrangement may not be considered good practice, the extreme sag is beneficial to the extent that it materially increases the arcs of pulley contact.

It will be noted, too, that in spite of the stretch of ropes to unequal lengths, each assumes about an equal portion of the load, as shown by the similarity of the curves of the driving halves. The equal distribution of the load was made possible in this instance by treating the ropes with Cling-Surface, made by the Cling-Surface Co., of Buffalo, N. Y., to prevent surface slip and to preserve the interior of all kinds of driving ropes and belting.



AN AUSTRALIAN ROPE DRIVE

This drive demonstrates that ropes working on the English system if properly treated, can be made to deliver maximum power without regard to their looseness, and that the constantly increasing length due to stretch need not affect the distribution of the load among the individual ropes. Under these conditions, resplicing is seldom necessary.

It may be added that a reliable antislip and preservative treatment, aside from the benefit to the ropes, is also desirable when the ropes are arranged to drive by the American system. In this instance the tighter grip of each strand on the pulley sheaves permits of a reduced initial tension on the drive, and consequently less weight is necessary on the tighteners.

## WRENCH TESTS

IN TESTS of wrenches made at the Watertown, Mass., Arsenal on the U. S. Testing Machine it was found that for a 10-in. wrench the Wright at a load of 700 lb. deflected 0.21 in. and 2 other makes 0.3 in. and to destruction respectively. At 960 lb. the Wright deflection was 0.34 in. and the second wrench failed while the Wright wrench kept on to 1,365 lb. before failure.

For the 12-in. wrench the first failure was at 1,000 lb., while the Wright wrench deflected 0.16 in. The second failure was at 1,586 lb., but the Wright wrench

stood up until 2,325 lb. was applied and was afterward heated and straightened as good as new.

The 15-in. Wright wrench carried a load of 2,580 lb. before giving way, while the others went out of commission at 1,100 and 1,800 lb., respectively. This wrench has several novel features. It is made with solid drop forged handle; the jaw is adjustable by a push of the thumb; and the rack is renewable if it becomes worn or broken. The Wright wrench is made by the Wright Wrench Mfg. Co. of Canton, O., which reports that contract has been let and ground broken for a large modern factory, which has become necessary through its rapidly increasing business.

This new plant will be located in South Canton on 2 lines of railroad, and will embrace about 3 acres of ground. Two buildings will be erected, 1 of brick and 1 of steel construction, which together will have a floor space of over 13,000 sq. ft. The machinery will be modern, much of it especially designed for the plant, which will employ over double the present number of men. With the increased equipment the company expects to have a capacity for 2,000 wrenches a day. The new factory will be ready for occupancy May 1st, and will be one of the most complete of its kind in the country.

## THE SWARTWOUT AUTOMATIC SAFETY WATER GAGE

THIS gage, manufactured by the Ohio Blower Co., eliminates so far as is possible the dangers resulting from broken gage glasses and the consequent damage to both attendant and boiler. Quick-closing automatic valves operate instantly, cutting off the flow of water and steam the instant the glass breaks.

In each of the 2 gage bodies there is an automatic valve held away from its seat while in use by a spring,

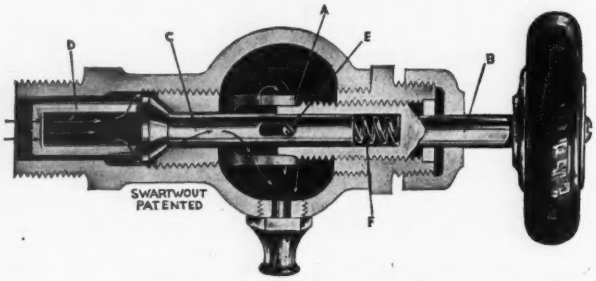



FIG. 1.—SECTIONAL VIEW OF SWARTWOUT GAGE COCK

shown at F in the sectional view of the gage cock. In case of breakage this valve is closed quickly by the steam pressure in the boiler. The valve is also controlled by the hand wheel so that both valve and valve seat are easily removed for cleaning without disturbing the gage at the boiler connections and without removing the packing of the gage glass.

As shown in the sectional view the screw E holds the parts of the valve together, and when taken out with a small screw driver or pen knife all the parts are released. At the inner end of the valve stem C, a flat scraper D loosens any sediment adhering to the boiler connection and as it revolves with every turn of the hand wheel the opening is cleared frequently. The removable valve case A is provided with 2 external threads of the same pitch but of different diameters, so that the threads on the inner end may slip by the outer internal thread when inserted. The threads are cut so that both sets engage the threads of the gage body at the same time, thereby insuring a good fit.

On replacing a broken glass, the hand wheel is turned forward until the valve is forced from its seat, thus allowing water or steam to flow from the boiler into the gage glass; the valve on the other gage body will then automatically open to equalize the pressure. In turning the hand wheel forward to force the valve from its seat, the movement of the spring F in stem B must first be taken up before the valve moves. Every turn of the wheel turns the valves upon their seats. In this way they regrind themselves automatically.

When the valve case is removed, there is an unobstructed opening into the boiler 1 in. in diameter, obtained without in any way disturbing the gage bodies. Another ingenious feature of the Swartwout Gage Glass is the gooseneck gage body. This form

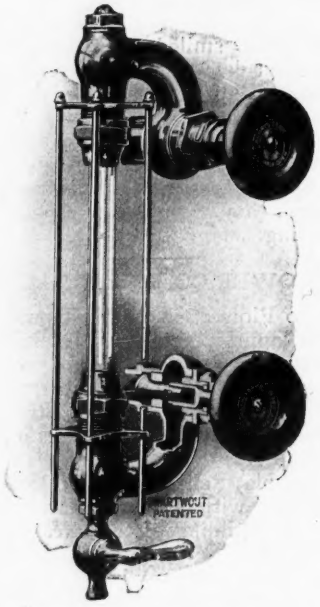


FIG. 2.—SWARTWOUT AUTOMATIC SAFETY WATER GAGE

of construction allows a gage glass 2 to 4 in. longer than with the straight body, thus giving greater visible range of water level.

Offsetting the gage glass renders the operation of replacing a broken gage glass an easy task. It is inserted through either the top or bottom of the gage without in any way disturbing the valves or seats. It need not be of any particular length, an inch or more making no difference. It permits the use of softer packings, which with the flexible construction relieves the strain on the gage glass, thereby greatly reducing breakages. In cleaning also the value of the gooseneck is apparent, for by simply removing the top plug or the drain cock at the bottom, the swab for cleaning is easily inserted, without in any way disturbing the valves or gage bodies.

The Swartwout water gage and gage cock are made extra heavy to withstand a pressure of 250 lb. They are adapted to all types of boilers and for marine, locomotive, stationary, and portable service. They are always provided with 4 rods and glass 24 in. long.

THE ANNUAL MEETING OF THE American Supply & Machinery Manufacturers' Association will be held at Jacksonville, Fla., April 5-7. Special railroad rates have been secured, full information being available on application to the secretary, F. D. Mitchell, 309 Broadway, New York.

## HINTS FOR BUYERS

THE wise buyer learns to read and study, to keep samples at hand and to question keenly and press for points to fill his data sheet as to performance. He tries to find ways to test goods and to distinguish grades, and to get an idea of cost of manufacture so as to know whether prices are fair or not.

If a buyer by watching the talking points made by salesmen gets some knowledge of the apparatus that he is to buy, he can ask intelligent questions that will bring out still further points, and thus enable him to increase his knowledge.

"What are my competitors doing with this contrivance?" "How has it acted where it was first sold?" "What flaws has it developed?" "What competing apparatus is there and how do the points of the 2 compare?" "What likelihood has it of being improved out of date or superseded by better apparatus?"

These points should be taken up not only with the salesmen but with all users who can be got at and who will give frank answers to questions.—System.

## GREDAG, THE NEW LUBRICANT

THE International Acheson Graphite Co., of Niagara Falls, has adopted this name "Gredag" for its line of Graphite Greases to distinguish its products from others in the field of lubrication. This will enable everybody who wishes to use the grease lubricant made by this company to be sure of getting it and to make certain of getting a standard lubricant. Furthermore, the new name, Gredag, will serve to distinguish the graphite grease products of the Acheson Co., which contain only the pure manufactured graphite and, therefore, have no grit in them.

All Acheson graphite is made in the electric furnace at a temperature of over 7,500 deg. F., which drives off in the form of vapor every known element except graphite. For this reason the Acheson Co. is enabled to make graphite that is practically pure. This practically pure graphite is blended in a thorough manner with a high grade grease in these lubricants, placing within the reach of all engineers a lubricant which is ready to use and will do excellent work. New grades and consistencies have been added, giving a line suitable for all places in any plant where a lubricant is used.

## THE SALESMAN'S WEAPONS

BUSINESS is war and the selling game is the skirmish and firing lines. It is the part of wisdom for those in the front of battle to see that they have the right weapons, kept always in good condition.

William C. Collins of the Keystone Steel & Wire Co. gives a summary of these which is worth using as a "shopping list" in providing equipment for the fray.

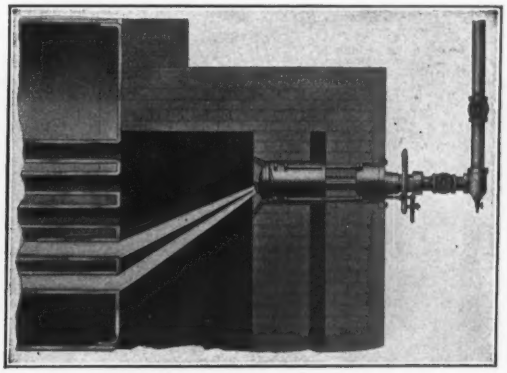
A genial smile often takes a buyer captive. A well cultivated voice helps to gain a pleasant hearing. Cheerfulness and optimism secure a welcome where a grouch fails. Looking at things from the other fellow's point of view helps you to think with him to a want for your goods. Full and correct information about the trade in general, prices, demand and supply, etc., save a salesman from serious mistakes and help him to win a customer's confidence. It is well to know how and when to "butt in," but to do it with caution, and, when in doubt, wait. The good salesman wins by boosting rather than by knocking.

COAL DUST GROUND to pass a 200 to the inch mesh will explode on contact with flame or an electric arc.

## THE MONARCH STEAM BLOWER

SOOT will form from any kind of fuel and will accumulate in the boiler tubes, causing a loss in efficiency and power and increasing fuel consumption. In order to get economical working, the flues must be kept clean, as the old mehod of attaching a nozzle to a steam hose, opening the boiler front, inserting the nozzle into each tube and driving the soot against the draft, into the back of the boiler, whence it is drawn back into the tube by the draft, does not clean the tubes. It simply stirs up the soot and ash and produces in the tubes cooling strains which are detrimental.

This is often the fault of the fireman, as he may do his best to remove the soot from the tubes, but going



THE MONARCH STEAM BLOWER IN OPERATION

against the natural draft, this cannot be done. In the Monarch steam tube blower is found a mechanically constructed machine, which is practical and which when permanently installed in the rear wall of the boiler blows the soot with the natural draft into the front of the boiler and also through the uptake to the chimney. Cleaning all of the tubes can be done in 5 min. without loss of time, steam pressure or fuel. As it is so easy and so rapid, the fireman can operate the blower 3 or 4 times a day, so that the boiler is always kept clean.

In 1 position, The Monarch blower cleans a section of the tubes, and by turning the handwheel slowly, all the tubes are covered in about 4 revolutions. In passing through the combustion chamber, the steam is superheated, consequently carries no moisture with which to cake the soot or ash and does the work of cleaning perfectly.

Steam is supplied to the blower by 1.5-in. pipes, with an arrangement of valves, so that any condensation which may be in the pipes is removed before the blower is operated. The illustration shows the method of operation better than words can describe it, and all that need be added, is that the blower is sent to any responsible concern on 30 days trial, without cost if it fails to do as the company guarantees.

Of the 3 things produced by coal, heat, soot and dividends, the blower helps to cut down the soot, and therefore gives more heat and larger dividends.

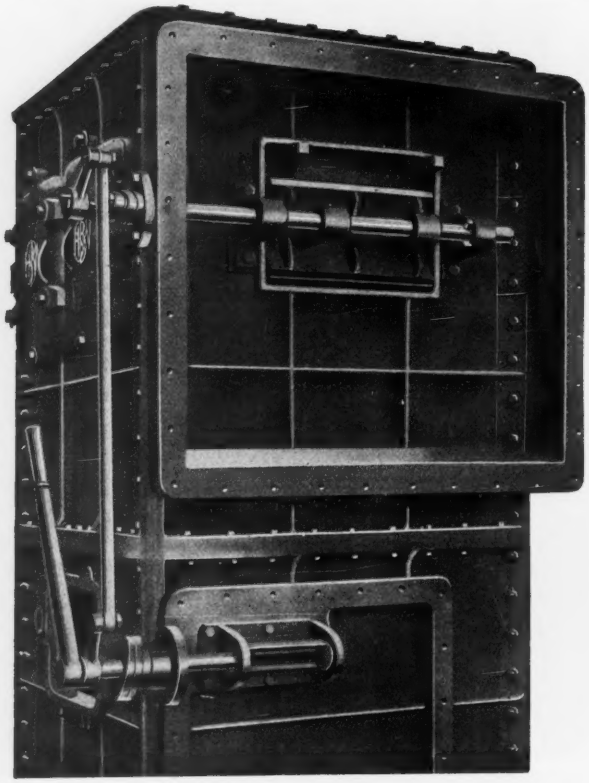
Another specialty made by the Monarch Steam Blower Co., of Troy, N. Y., in line with the steam tube blower, is the Monarch Steam Draft Blower, for increasing draft where cheaper grades of hard and soft coal are used. The essential feature of this blower is that it supplies the maximum volume of oxygen to the furnace and a minimum of steam.

It is simple in construction, steam and air being admitted to the grate in proper proportion, to give per-

fect combustion, and may be applied to any kind of furnace where desirable under the grate, or in the stack. The use of steam as well as air tends to prevent the formation of clinker and serves to moisten the lower strata of the fuel bed, so that it is kept porous, and the air can pass through it uniformly.

## COMBINED VALVE-GEAR FOR HEATERS AND RECEIVERS

SOME time ago, the Harrison Safety Boiler Works, of Philadelphia, put out a new type of combined heater and receiver for use in connection with exhaust steam heating and drying systems. The peculiar feature about this heater was the extra-large separator attached to and forming a part of it and intended to



COMBINED VALVE GEAR FOR HEATERS.

purify all the exhaust steam delivered by the engine, including not only that entering the heater to heat the boiler feed-water, but also the surplus passing to the heating or drying system.

In order to be able to cut the body of the heater out of circuit, as for cleaning or inspection while the heating system continues in operation, a manually controlled valve was provided to shut the separator off from the heater body and another to close the passage between the separator trap and the overflow of the heater, the latter being necessary in order that the trap might continue to drain the separator when the heater was cut out of circuit without allowing steam to enter the heater by way of the separator drain pipe and trap.

It is obviously necessary that both valves be closed when it is desired to cut the heater out, also that if a man is to enter the heater body while the separator is receiving steam, some provision must be made against accidental opening of the valve. On small heaters it was found practicable to connect the spindles of the 2 valves together and to turn them by a single lever, where the handle for operating the valves is attached to the spindle of the upper valve, while a connecting rod driven from a short crank on this spindle operates a second crank keyed to the spindle of the lower valve.

The steam valve between the separator and the heater is of the semi-cylindrical rotating type, and is held against its seat by springs, and also by the pressure of the steam. Where a pressure of 5 lb. per square inch or more is carried in the heating system, the total pressure over the valve of a large heater would render operation difficult, by forcing the valve tightly against the seat. In order to obviate this, a special valve gear has been devised.

The operating handle of this valve is attached to the spindle of the lower valve, and the lower end of the connecting rod engaging the pin on the short crank of the lower spindle is slotted, so that the lower spindle has a certain excess of motion over that of the upper spindle. The amount of this excess motion is so adjusted that in closing, the upper valve shuts off first, as shown in the illustration, and then stands still while the lower valve rotates through the remaining arc of its motion, which it is enabled to do by reason of the lost motion in the connecting rod. In this way, the upper valve is closed while there is still pressure in the heater to balance the pressure of steam on the outside of the valve. Subsequently the lower valve closes, cutting off the heater, after which any steam contained therein will be condensed or escape from the vent pipe with which an open heater is always provided. Once both valves are closed, the operating handle is removed from its spindle before the cleaning doors of the heater are opened, making it impossible for the steam valve to be opened until the handle is replaced.

In opening the valves, the lower valve will swing through a sufficient arc to establish communication for steam through the separator drain pipe and trap into the heater, equalizing the pressure on the steam valve before the latter begins to move. Once the pressure is the same on both sides of the valve, the latter will slide easily, and the operation of opening can be completed. During this operation the valve in the vent pipe of the heater should be closed, to permit pressure to build up in the heater when the lower valve is first opened.

## NEW FORM OF HEAD FOR BOILER TUBE CLEANERS

ECONOMICAL utilization of fuel is now receiving considerable attention throughout the country and the majority of engineers realize that the getting of the greatest amount of heat out of coal does not end with the grate. In fact, what really counts in making steam is the transferring of the heat from the gases of combustion into the water of the boiler and anything which tends to retard this transmission results in a direct loss.

There are so few localities in which boilers get absolutely pure water that nearly every fireman and engineer is confronted with the proposition of keeping his boiler tubes free from scale. The exact loss in boiler efficiency resulting from the formation of scale in the tubes has never been satisfactorily determined, but it is well known that both the efficeincy and the steaming capacity of boilers is reduced to a marked degree when the tubes are allowed to become coated with scale.

The Lagonda Manufacturing Co., of Springfield, Ohio, has recently put out a new cleaner equipped with what is known as the "Quick Repair Head." This head is the result of several years of experimenting, and is simple and compact. It is attached to the turbine proper by means of the coupling and an adapter. As can be seen from the accompanying cuts, a spider screws directly into the coupling, and has 3

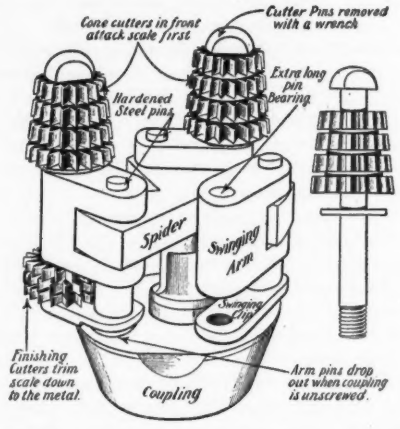

Cone cutters in front attack scale first
Cutter Pins removed with a wrench
Extra long pin Bearing
Hardened Steel pins
Spider
Swinging Arm
Swinging Pin
Finishing Cutters trim scale down to the metal.
Coupling
Arm pins drop out when coupling is unscrewed.

FIG. 1. QUICK REPAIR HEAD WITH ONE OF THE CUTTER PINS REMOVED

arms, on the ends of which are attached the swinging arms carrying the cutter wheels. There are 4 cutters on each swinging arm; the front one being of the cone pattern, is the first to attack the scale, and loosen it. Each cone cutter is then followed by 3 star cutters which remove the scale down to the metal, leaving a bright, polished surface.

The most important feature of this head is the ease with which new cutters can be inserted. The cutter pin can be quickly removed by means of a wrench and all of the cutter wheels taken out. In

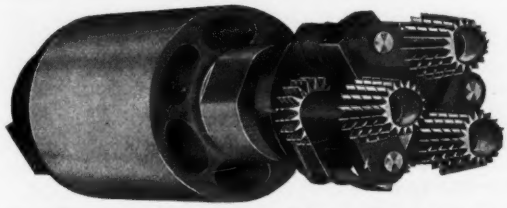


FIG. 2. THE QUICK REPAIR HEAD ON A WEINLAND WATER TURBINE CLEANER

case it is necessary to take the entire head apart, it is only necessary to unscrew the spider from the coupling; this allows the 3 arm pins to drop out and the whole head is dismantled.

No rivets or small parts are used and as the makers furnish an extra supply of sharp cutter wheels with each head there is no reason why any operating engineer should struggle along with a scale remover having dull cutter wheels.

This idea of keeping the head equipped with sharp cutters results in a marked saving in the time necessary to remove a given amount of scale from boiler tubes. In plants where the boilers are being worked to the limit and it is necessary to have all of the boilers in service during part of the day this ability to remove the scale and place the boilers back into service again quickly is a distinct advantage.

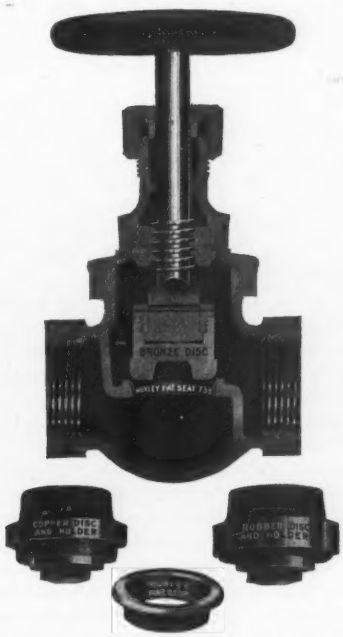
The Quick Repair Head is compact and heavily built. The arms are thrown out against the scale by the action of centrifugal force, which causes the cutter wheels to bear firmly against the scale; but should a constricted part of the tube be met, the arms fold in and do not injure the boiler tube in the least. The flywheel effect of a compact head like this is quite noticeable; when exceptionally hard scale is encountered, it is only necessary to back the cleaner out a little and let the head speed up and when it is forced against the scale again it is generally found that the cleaner will eat its way through without further trouble.

## A NEW VALVE AND DETAILS

NEW valves are easy to put in on a system when installing it; but to put in a new valve on a system already in place is usually a nuisance. Valves which can be made new without disturbing the valve bodies are, therefore, a boon to the long suffering engineer and are likely to save much grumbling and overtime.

Such an one is the Huxley valve made by the Nelson Valve Co. of Chestnut Hill, Philadelphia. Both seat and disk are renewable at small cost and this gives a valve as good as new. The large sectional view shows the construction with regrinding disk and Huxley patent seat, while the smaller details are the copper disk with holder and retainer, the seat and the rubber disk with holder.

It is evident that, barring accidents, such a valve is everlasting and a single stock of valve bodies with




THE HUXLEY VALVE WITH REGRINDING DISC AND DETAILS OF OTHER FORMS OF DISC AND SEAT

appropriate discs provides for steam lines, hot or cold water lines, compressed air, high or low pressure, oil or what not.

The shell of the Huxley seat, which is removable, is tapered and fits the seat in the body tight, preventing working loose or leakage. Yet it is a moment's work, if the seat becomes cut, to take it out and slip in a new one.

The Huxley valves are made globe or angle, screwed or flanged as stop or checks in sizes from ⅜ in. to 3 in.

## NEWS NOTES

THE INSTITUTE OF OPERATING ENGINEERS was organized and temporary officers elected at a meeting held on March 11 at 12 John St., New York City. The objects of this organization, as given in detail in Practical Engineer for November, 1909, page 676, are to assist in the education of its members, to procure the adoption of a uniform apprenticeship system for training engineers, and to get economical and businesslike methods adopted in plant operation. The temporary officers as chosen were: President, J. C. Jurgensen; 1st vice-president, J. J. Chisholm; 2d vice-president, H. M. Elder; 3d vice-president, J. Geo. Ould; secretary, M. W. Rice; treasurer, Adam Harkness. These officers are to have charge of outlining a permanent plan of organization, and it is expected that a national convention will be called to meet in June and perfect a permanent organization of the institute.

G. M. DAVIS REGULATOR CO. reports the shipment of the third 36-in. special relief valve to the Detroit Edison Co., Delray, Mich. This valve is made with special features which enable it to be opened or closed hydraulically by hand or automatically. A special pilot valve was furnished to be controlled by vacuum which would throw water into the lower dash pot after the valve had opened, insuring a cushioning effect for the valve in closing. The total weight of this 36-in. valve is 9500 lb. and it contains 1000 lb. of special bronze working parts including the disk, dash pots and seat rings. The Davis Co. also reports the receipt of an order for 3 standard 36-in. relief valves to be made for the Commonwealth Edison Co., to be installed in the Quarry Street Station, Chicago. When these valves are installed there will be 7 36-in. Davis relief valves in the 1 plant.

WALTER B. SNOW has more than doubled his office facilities for the carrying on of his work as publicity engineer on machinery and technical matters, by removal to Rooms 421-425 in the same building where he has formerly been situated, at 170 Summer street, Boston. Mr. Snow has also added to his staff Benjamin Baker, formerly of the Boston Transcript, and Herbert M. Wilcox, mechanical engineer.

ON MAR. 1, W. G. Lighty, formerly engineer of the Schiller building, became chief engineer of the Farnham-Willoughby interests with headquarters at 72 Madison street, Chicago, and charge of all plants in the loop district operated by that company.

THE FINANCIAL REPORT of the National Exhibitors' Association for the convention at Columbus in 1909 is just in print and shows receipts for that convention of $4,129 and disbursements $4,215.88, leaving on hand a balance of $971.66 to start the work of the Rochester convention. The 1910 convention will be held at Rochester, N. Y., Sept. 12-17.

THE 1910 MEETING OF THE International Master Boiler Makers' Association will be held at Niagara Falls, Ontario, May 24-27. Headquarters will be at the New Clifton and business sessions will also be held at that place.

DETROIT IS TO HAVE, June 20 to July 6, a great industrial exhibition in which it is planned to accommodate 250 to 300 exhibits. Detroit's industries will be shown by products and running machinery on a large scale. The committee in charge consists of 275 of the leading manufacturers.

AT WORCESTER, ENGLAND, an electric plant driven by a windmill has just been completed in which a 75-ft. tower carries a 24-ft. turbine. Generator, storage battery and switchboard are on the ground, the battery and distribution being in a building at some distance, and the dynamos at the foot of the mill, belt driven from the vertical mill shaft. The capacity is 4 kw. at 70 volts running about 100 lights and a number of motors.

THE COMPLETE HYDRAULIC EQUIPMENT for the Red Cedar plant of the Chippewa Valley Railway, Light & Power Co., Eau Claire, Wisconsin, comprising 1 3600-hp. generator unit operating under 48 ft. head and placed in a hollow dam of the Ambursen Hydraulic Construction Co.'s build, with complete hydraulic governor and 170-hp., exciter unit, also head gates, trash racks, etc., for the plant, has been ordered from Allis-Chalmers Co. of Milwaukee. This contract which was based on the engineering merits of the design of the machinery, considered as a guarantee of economy in operation, covers the first of 4 generator units and the first of 2 exciter units which are to comprise the ultimate capacity of the plant.

ON FEB. 26 MEMBERS of the N. A. S. E. visiting club of Chicago attended a meeting of Illinois No. 10 at Ottawa. Twenty-two engineers took the trip and were greatly benefited by the meeting which developed into a discussion of a state license for engineers. Mayor James Farrel gave the boys the freedom of the city and Lee O'Neil Browne, state representative for that district, entered at length into the subject of state license for engineers giving many valuable suggestions and pledging his support to a bill of the proper sort for the licensing of engineers.

## BOOKS AND CATALOGS

THE PRACTICAL ENGINEER POCKET BOOK, which is offered by the Magnolia Metal Co., of New York City, at a price of 40 cents to engineers, contains 684 pages of engineering information, an astounding amount of matter for this price. The book is well indexed, so that reference to any of the information contained is readily made. The range of subjects treated is as wide as the subject of mechanical engineering. Many of the examples of practice refer to English construction, but the mathematical tables and the fundamental facts are the same in all countries, and the experimental data are of great value. Steam engines and boilers, pumps, elevators, riveted joints, valve diagrams, power of shafting, the use of the entropy temperature diagram, steam turbines, gas engines and producers, spur gearing, are a few of the headings under which the data are classified.

ENERGY IN THE FORM OF WORK, heat and transformations is discussed at length by Sidney A. Reeve in an interesting book just from press. It is in the class of practical books as it discusses largely the theory of how different forms of energy are manifested and what is meant by the mathematical treatment of them. This does not mean that equations are largely employed or that the book is a mass of mathematical formulas, but the author has endeavored to put into the form of language the facts in regard to energy which are shown by mathematical calculations and equations. It is a book which will interest those who are inclined to dig into the philosophy of things and try to understand the why and the how, but will not be of interest or of particular value to those whose interest leads them in the direction of doing rather than thinking. The author has unfortunately used a number of terms which are not common and which to the student who approaches the subject for the first time are rather confusing, although they become entirely plain on careful reading and study of the book. The book has 240 pages, illustrated by diagrams where needed and fully indexed, in substantial cloth binding.

THE ISSUE OF Harper's Weekly for March 12 contains the first of a series of 5 articles by the Duchess of Aosta, descriptive of a hunting expedition in South-Cen-

tral Africa. In this number appears an account of John D. Rockefeller's proposed Foundation, which will, it is believed, be made the vehicle for the distribution of the multimillionaire's fortune. Charles Johnston writes upon "The Mother of Parliaments." William Hemmingway contributes an interesting article upon the importance of an adequate amount of sleep. This issue contains an impressive story of India by Coningsby William Dawson.

WIRELESS TELEGRAPHY AND TELEPHONY POPULARLY EXPLAINED. By Walter W. Massie and Charles R. Underhill. New York, 1908, 76 pages, illustrated, cloth bound, price $1.

That communication can be made through space seems on the face of it most miraculous and familiarity with the method by which it is done renders it no less so. It is one of the wonderful achievements of recent years and, while not destined to displace the more common forms, the wireless communication, both by telegraph and telephone, has fields where it can be of the greatest advantage. A brief treatise, therefore, like the one under consideration which gives an outline of the methods and apparatus used in this work, is of importance. The authors treat of the principles and theory of wave transmission; then take up the apparatus, discuss its uses and finally forecast the future possibilities. While the reading of this book will not make one an expert operator or even an expert in any branch of wireless communication, it will give a clear idea of the elements of the subject sufficient for the purpose of the average reader.

THE GREEN FUEL ECONOMIZER CO., of Matteawan, N. Y., has recently issued a catalog entitled Green Steel Plate Fans, which describes in detail the various good features of the fans manufactured by this company for producing induced or forced draft and ventilating purposes.

THE J-M PACKING EXPERT is an interesting leaflet which comes from the H. W. Johns-Manville Co., and the first issue starts the story of Asbestos, where it comes from and how it is used.

THE GENERAL ELECTRIC CO. has just issued an attractive booklet descriptive of its Multi-catch Socket. This socket is primarily intended for fixture work, although it may be used wherever the standard socket is used. Its appearance is practically the same as that of the standard type, the great advantage in its use lies in the facility with which it can be attached to a fixture containing a husk. No screw driver is needed, the shell being snapped in place and rigidly held at 4 points. This socket is described and illustrated in booklet 3700.

Those contemplating the installation of a small plant containing but 1 exciter and 1 generator should find the bulletin No. 4711 of considerable interest and use. The publication treats of panels designed only for such service, no provision being made for operating generators in parallel, although the instrument equipment is suitable for balanced or unbalanced loads. The bulletin lists panels for two-phase and three-phase circuits, shows the connection diagrams for such panels, and gives dimensions and capacities.

The statement that with no additional steam the net output of a non-condensing engine plant may be increased 75 per cent by exhaust-steam turbines cannot fail to result in more than a passing interest. Bulletin No. 4712 takes up the subject of Exhaust Steam Turbines Installations in considerable detail.

A pamphlet on the subject of Building Lighting should be not only of interest but of service to managers of hotels, apartment houses, and all large buildings of either a public or privtae nature. This pamphlet contains references to a number of important installations of lamps having Tantalum and Tungsten filaments and also consider the G. E. Mazda lamp which is the latest development in metal filament lamps.

ELYRIA TYPE B single acting tandem gas engine is interestingly described in a folder of the Elyria Gas Power Co., of Elyria, O. Other styles are treated in a larger booklet and "The little big engine" is shown in detail. The sizes run from 25 to 125 hp.

"HYDRAULIC VALVES AND FITTINGS" is the title of a 120 page illustrated catalog just issued by the Watson-Stillman Co., 50 Church St., New York. Its pages list a great number of types and combinations of hydraulic valves and fittings and any engineer will find this book handy when figuring on new hydraulic installations or making changes in old ones. The book will be sent free to any one requesting Catalog No. 78.

IN CATALOG K, which has just been issued by the Lagonda Manufacturing Co. of Springfield, Ohio, the construction and use of its new Quick Repair Head is fully discussed. It points out the advantage of always having sharp cutter wheels on a boiler cleaner, and shows by diagrams how easily the cutters can be renewed. The complete line of air, steam and water turbine boiler tube cleaners, built by this company, is also illustrated and described, as well as a new cleaner for fire-tube boilers which has just been brought out. Copies of this catalog may be had by addressing the above company.

"THE THERMAL CONDUCTIVITY of Fire-Clay at High Temperatures," by J. K. Clement and W. L. Egy, issued as Bulletin No. 36 of the Engineering Experiment Station, University of Illinois, is a report of the results of experiments on the thermal conductivity of several commercial fire-clays at high temperatures. A detailed description of the instruments and methods of high temperature measurements is included. Copies of Bulletin No. 36 may be obtained gratis on application to W. F. M. Goss, University of Illinois, Urbana, Illinois.

"BELMONT PACKING." That is the title attractively displayed on the cover of General Catalog No. 3 which is itself attractive as well as full of good packing information and tells of the products of Clement Restan Co. of Philadelphia, Pa. This is more than a catalog; it's a book of 160 pages showing the make up and qualities of all kinds of packings for all sorts of purposes as well as hose, rubber bushings, rubber belting and other products. Its value is many times the cost of the request which will bring it to you.

B. F. STURTEVANT CO. is placing on the market an electrically-driven dust-blowing set which is specially designed for blowing the dust and dirt from around motors, switchboards and other machinery. It consists of a light aluminum case containing a pressure fan direct-driven by an electric motor and is arranged to operate from lamp sockets. A 12-ft. length of 1.25-in. flexible air hose is attached with a polished aluminum nozzle and 20-ft. electric cord with plug, giving a working radius of 32 ft. from the light socket. It gives a convenient means of cleaning quickly any kind of apparatus and by its portability and adaptability to be driven from a lamp socket it is available in almost any place. The catalog describing it can be had by writing to the B. F. Sturtevant Co., Hyde Park, Mass.

GAS POWER PLANTS built by the Snow Steam Pump Works, Buffalo, N. Y., and the Power and Mining Machinery Co., Milwaukee, Wis., are beautifully illustrated in a 60-page book just received. It is a photographic record of the works and work of the 2 companies and of notable installations which they have made.

WISCONSIN ENGINE CO. of Corliss, Wis., has planned to issue a series of bulletins containing engineering data of real value and service. A handsome cover is provided to bind these, and the first one which treats of Heavy Duty Corliss Engines makes one wish to be sure of receiving all the series. Copies are ready for those interested in power plants. Sizes and dimensions, complete details of action, methods for finding rated power of simple and compound engines, condensing water needed are some of the data given.

IN THE 1910 CATALOG of the Ferro Company are embodied a number of novel features and descriptions. This not only describes the Ferro marine engine of 1910 design, showing how the refinements in it have increased the power from 15 to 20 per cent, but chapters are given on the offset cylinder, the split adjustable bearings, possible pressure, oiling system, efficient concealed cooling system and instructions showing how to get the best results from the marine engine. Description of the jump spark and make and break ignition systems are also included, showing where each system should be used.

THE DEPARTMENT OF MINING Engineering of the University of Illinois has recently issued a circular descriptive of the course in Mining Engineering lately established at the University. This circular can be obtained by applying to the Registrar of the University, Urbana, Illinois.

The bill establishing the Department of Mining Engineering in the state University was passed by the last Legislature of Illinois and was cordially supported by the United Mine Workers of America and the Illinois Coal Operators' Association, so that the department can truly be said to have been established in response to a demand coming from all branches of the mining industry.

The mining and metallurgical industry of Illinois in 1907 represented an output valued at over $150,000,000.00. The general public is, however, so accustomed to consider Illinois as an agricultural state, that it does not realize that she ranks third among the states of the United States in the amount of her mineral and metallurgical output, being surpassed in this respect only by Pennsylvania and Ohio.

For many years, Illinois has occupied second place among the coal producing states, and the rapid development of the iron industry about Chicago and around the southern end of Lake Michigan has already placed the state well up among the iron and steel producing states. As a producer of petroleum, of clay and of sand products, also, Illinois, stands well toward the front. It is, therefore, eminently fitting that the mining industry should be represented in the State University.

The Department of Mining is especially fortunate in having located at the University of Illinois the first substation of the general testing station of the Technologic Branch of the U. S. Geological Survey. At this station, mine bosses and others are trained in the use of oxygen helmets. The station is a great advantage to the students in Mining Engineering as it brings them in contact with the men engaged in mining practice from all parts of Illinois and the surrounding states.

The Department of Mining Engineering stands ready at any time by lectures or other means to cooperate with and assist any organizations in the state that aim to help those who are preparing to take the State examination for Mine Manager, or Examiner or for Hoisting Engineer, or which aim to assist the ordinary miner to better understand his daily work.

THE PURCHASE OF COAL. This is certainly one of the most important branches of the purchasing in connection with a power plant and the little book by Arthur D. Little of Boston on this subject is full of interesting information. It deals with the various elements in coal, the buying of coal on the basis of its heat value, the possible saving by this method, the basis used by the government in making purchases, the effect of moisture on the value of coal, the influence of foreign matter, ash and impurities, the importance of getting a correct sample, economical methods of burning coal and the importance of having examinations made by the boiler plant. The book can be had by writing to Arthur D. Little, 93 Broad St., Boston.

POWER PLANT SPECIALTIES, particularly for handling feed water and cleansing steam, are the product of the Power Plant Specialty Co., Chicago. An interesting booklet describing the Vater products, including the 2-stage separator for taking oil and water from steam, the open heater, the water softener and the pressure and gravity filter, contains sectional views and descriptions, with testimony of those who have used them. It is Bulletin 103 and will be sent by the company on request.

IN ITS FUEL ECONOMIZER catalog the B. F. Sturtevant Co., of Hyde Park, Mass., emphasizes the metal-to-metal joints, positive scrapers, staggered pipes, all which help to save fuel and avoid repairs. This company is also sending out literature calling attention to its experience in fan and engine design and in mechanical draft engineering, meaning by this term the special design of a draft apparatus to suit the conditions of each plant as distinguished from the use of stock apparatus.

AMERICAN FEED-WATER PURIFIERS are fully described in a catalog just received from the Stroud-Wilfong Co. of Philadelphia. This booklet gives results and many advantages to be derived by the use of this purifier.

SARCO PYROMETERS are fully described in bulletin No. 3 T, issued by Sacro Fuel Saving & Engineering Co. These instruments are of the electrical type, and are manufactured in forms either to indicate or record the temperature of the flue gases or furnace.

POWER FROM exhaust steam is discussed from various standpoints in a catalog recently issued by the American Regerator Co. of Chicago. The catalog takes up in particular a description of the American Regenerator which is a feed water heater placed in the steam line between the high-pressure steam engine and the low pressure turbine.

KERR TURBINE CO., WELLSVILLE, N. Y., has just issued two new bulletins. No. 9, "Turbo-Blower Units," and No. 10, "Steam Turbine Generators, Steam Turbine Centrifugal Pumps." The first bulletin illustrates practical outfits for forced and induced draft, gas works service and for furnishing blast for cupolas. The other bulletin includes generating sets for electric power and lighting, and pumping units for boiler feeding, fire service, water supply, circulating condenser water, draining sumps, and for other service where water must be delivered at moderate or high pressure or against considerable head. Both bulletins will be mailed upon request.

FROM A. L. IDE & SONS of Springfield, Ill., comes a copy of Bulletin 15, just from press, describing the Ideal Engine and showing clearly the many interesting details which go to make up the efficient design of this excellent prime motor. The catalog is available to any interested engineer, who sends a request for it.

"FUEL TESTS WITH ILLINOIS COAL," issued as Circular No. 3 of the Engineering Experiment Station of the University of Illinois, presents the results of an elaborate series of tests conducted at the fuel testing plant of the United States Geological Survey. The circular is compiled by L. P. Breckenridge and Paul Diserens. It deals only with coals taken from mines within the state of Illinois. The investigations described include steaming tests under boilers, gas producer tests, washing tests, coking tests, briquetting tests, and tests to determine composition and heating value. From the results stated it appears (1) that the average calorific value of Illinois coal (ash and moisture free) is 14,319 B. t. u.; (2) that its evaporative efficiency is but slightly affected by the moisture it contains; (3) that its evaporative efficiency decreases as the ash and sulphur content increases, and that when burned in a hand-fired furnace its evaporative efficiency decreases as the amount of fine coal contained in it increases; (4) the performance of Illinois coal in a gas producer compares favorably with that of any other bituminous coal tested at the U. S. G. S. laboratory; (5) one-fourth of all the samples tested may be used for the manufacture of coke; (6) briquetting improves the evaporative efficiency of Illinois coals only when the raw coal is in the form of slack or screenings. Copies of Circular No. 3 may be obtained gratis upon application to W. F. M. Goss, director of the Engineering Experiment Station, University of Illinois, Urbana, Ill.

AN ATTRACTIVE BOOKLET descriptive of the Swartwout Gravity Closing Ventilators has just been issued by The Ohio Blower Co., Cleveland, Ohio. Simple illustrations present the special features of design and construction which make this ventilator distinctive.

THE NORTHERN EQUIPMENT Co., of Chicago, Ill., has recently published an attractive 48-page booklet. While this is descriptive of the Copes boiler feed regulator and pump governor, it is at the same time a valuable treatise on the question of automatic vs. hand boiler feeding. The economies resulting from holding the rate of inflow of feed water exactly proportional to evaporation are discussed, and by Bristol charts, taken from actual plants, it is shown that automatic regulation results in a real economy. The catalogs will be sent free upon request by the Northern Equipment Co., Chicago, Ill.

"TESTS of 2 TYPES of Tile-Roof Furnaces under a Water-Tube Boiler," by J. M. Snodgrass, has been issued by the Engineering Experiment Station of the Univresity of Illinois as Bulletin No. 34. This bulletin reports a short series of boiler trials made for the purpose of comparing boiler performance when operating with 2 types of furnace roofs. Copies of Bulletin No. 34 may be obtained gratis fupon application to W. F. M. Goss, University of Illinois, Urbana, Illinois.

THE ECONOMY VALVE CO. sends out 2 folders describing specialties which it manufactures. The Economy furnace regulator is described in one and is a device for controlling the damper from the steam pressure. The Reams steam separators, their second device, is made in 2 types, one for steam flowing upward, the other for steam flowing downward. Both types are described and illustrated in the folder.

REEVES GAS ENGINES are described in detail in a catalog recently issued by the Reeves Engineering Co., of Mt. Vernon, Ohio. These engines are built in capacities from 50 to 200 hp., and the description of details given in the recent catalog will be of value to all engineers interested in gas engines.

## TRADE NOTES

ALLIS-CHALMERS CO. HAS recently received an order from the Diamond Rubber Co. of Akron, Ohio, for a rather novel installation. This will be a low pressure turbo-generator set receiving its steam supply from the exhaust of the vulcanizers and other apparatus. The set has a capacity of 1000 k.w. when running at 1500 r.p.m. and will furnish 25-cycle 2-phase, 240 volt current. The turbine will have a continuous overload capacity of 1250 k.w. The initial steam pressure will be about 16 lb. absolute and the vacuum vary from 26 to 28 in. In connection with this turbine, a special condenser outfit is being furnished. The condenser head will be connected to the expansion joint of the exhaust line where it leaves the turbine. The mixture of steam, water and air coming from the head will be removed by a centrifugal pump driven by a small impulse steam turbine. The dry air pump will be driven by a small reciprocating engine. Both these auxiliaries will run on high pressure steam and the exhaust from them, which will be at atmospheric pressure, will be used in the large low pressure turbine.

RECENT ORDERS TAKEN BY The Ohio Blower Co., Cleveland, Ohio, for its Swartwout steam specialties include Swartwout cast-iron exhaust heads for the following parties: Peoria Water Works, Peoria, Ill., 1 14-in.; United Coal Co., Rich Hill Mine, Meadow Lands, Pa., 1 8-in. and 2 19-in.; Westmoreland Coal Co., Madison, Pa., 2 10-in.; John B. Hughes Heating Co., St. Louis, Mo., 1 10-in.; Moody & Almon, Montpelier, Vt., 1 10-in.; United Coal Co., Ella Mine, Milesville, Pa., 1 8-in.; Great Knitting Co., Scranton, Pa., 1 6-in. and 1 8-in.; Shelby Steel Tube Co., Shelby, Pa., 1 8-in.; H. F. Watson, Erie, Pa., 1 8-in.; O'Fallen Electric Light, Power, Heat & Water Co., O'Fallen, Ill., 1 7-in.; Bauer Cooperage Co., Lawrenceburg, Ind.; 1 7-in.; Love & Roth, Cincinnati, Ohio, 1 7-in.; Little Cahaba Coal Co., Piper, Ala., 1 7-in.; United States Sand Paper Co., Williamsport, Pa., 1- 6 in.; Ford City High School, Ford City, Pa., 1 6-in.; High School, Battle Creek, Mich., 1 2.5-in. and 2 6-in.; S. Anargyros, New York City, 1 6-in.; The Laclede Gas Light Co., St. Louis, Mo., 1 6-in.; and others to Normal School, Farmsville, Va.; Rome Metallic Bedstead Co., Rome, N. Y.; Delray Salt Co., Detroit, Mich.; Piqua Heating & Plumbing Co., Piqua, Ohio; Board of Education, Bradford, Ohio; Board of Education, Fremont, Ohio; Edw. Stearner Co., Erie, Pa.; and also Swartwout separators for Virginia-Caroline Chemical Co., Almont Factory, Wilmington, N. C.; Virginia-Caroline Chemical Co., Navassa Factory, Wilmington, N. C.; W. H. Johnson & Son Co., Kokomo, Ind.; Standard Sanitary Mfg. Co., Dawes & Myler Works, New Brighton, Pa.; Sandusky Portland Cement Co., Dixon, Ill.; The Sherwin-Williams Co., Kensington, Ill.; Hopkins Co., Manassas, Va.; Canedy-Otto Mfg. Co., Chicago Heights, Ill.; Garfield Worsted Mills, Passaic, N. J.

E. I. ODELL, superintendent of the Terminal Elevators at Armourdale, Kansas, cites an experience with Albany grease which goes far to prove the claim of the only makers, Messrs. Adam Cook's Sons, that it is "the perfect lubricant."

He says: "We had one or two bearings in particular which had run hot for over 2 years, defying all kinds of grease and keeping a man busy with ice and water in connection with about fifteen different kinds of grease, but without success until we used Albany grease, fed through one of your grease cups, which made them run cold inside of 24 hr. and we have had no trouble of that

kind since. Albany grease has proved itself thoroughly efficient and is all and more than you claimed for it."

G. M. DAVIS REGULATOR CO. reports the sale and shipment to the Tennessee Coal Iron and R. R. Co., Ensley, Ala., of a 28-in. back pressure valve for vertical pipe to be used in connection with an open heater on which 5 lb. back pressure is carried. This big back pressure valve receives the exhaust after passing through the heater from a 3,000 hp. Corliss engine which supplies power to the machine shops of steel mills. Due to the extra duty and the fact that ¾ of the steam will be exhausted through the valve at each stroke of the engine it became necessary that this valve be designed to be opened quickly and to close slowly, without a violent pulsation and to be noiseless in its operation. These valves are made for light or heavy service in sizes ranging from 2 to 36 in.

AT THE WEST ALBANY, N. Y., POWER STATION, which furnishes light and power for the New York Central car shops, there were recently added 3 600-hp. Edge Moor boilers, making a total of 3,800 boiler horsepower. As in the case of the older boilers, the new ones are equipped with Taylor Gravity Underfeed Stokers built by the American Ship Windlass Co., of Providence, R. I.

In this power plant the mechanical draft for the stokers is furnished by 2 turbo-blower units, each consisting of a Bliss turbine and double width "squirrel cage" fans manufactured by the Massachusetts Fan Co., Watertown, Mass. In this new type of fan, which is the latest of the multiblade types, interblades extend almost to the center to set the entering air in motion gradually.

PRODUCER GAS POWER PLANTS installed by the Jacobson Engine Company are meeting with general satisfaction as will be noted from the following letter received by that company from Purdy Bros. of Lucasville, O.: "It gives us pleasure to be able to state that the installation of your producer gas power plant at our flour mill has proved one of the best moves we ever made. This 50-hp. automatic cut-off tandem engine is doing more work than the steam engine which it supplanted, which was capable of delivering over 60-hp., and which was supplied with steam by a boiler of an aggregate capacity of 75-hp."

AS A RECORD for service the following letter, written by Wm. C. McCormick to the American Steam Gauge & Valve Mfg. Co., is worthy of attention:

"Kindly advise me if you can furnish me with two Indicator springs, Nos. 60 and 80, and what would be the cost if you were to send same by mail.

"The number of my Indicator is 941, and has been in my possession since 1888, having been in almost continuous use since that time, being used on about every variety of makes during my practical experience of thirty years.

"Can you refer to your past records and tell me when this instrument was made and to whom sold? I purchased it from a jobber in Cincinnati the summer of 1888.

"If you have perfected any new instruments of any kind, and if you would kindly send me circulars or whatever printed matter you may have describing same, the favor would be greatly appreciated.

"Perhaps it will interest you to know that my Indicator is as good as the day when I bought it, and I prize it above all others.

"I have used the . . . and other makes, but prefer my American-Thompson."

THE YORK MANUFACTURING CO. reports the following among its list of recent sales: Palmetto Ice Co., Palmetto, Fla., 60-ton ice making plant; Merchants Ice & Cold Storage Co., Los Angeles, Cal., 1 100-ton cross compound machine and compression side; J. F. White & Co., Mt. Morris, N. J., 1 4-ton refrigerating plant; Wells-Sapulpa Packing Co., Sapulpa, Okla., 1 56-ton refrigerating plant, brine system; St. Louis Brewing Ass'n, St. Louis, Mo., 1 175-ton tandem compound machine, and compression side for Hyde Park Brewery Branch; City of Paris, Paris, 1 10-ton refrigerating plant; New York State Industrial School, Industry, N. Y., 1 10-ton refrigerating plant; P. C. Lofland, Snow Hill, Md., 1 6-ton ice making plant; S. P. Wadley & Co., Waterloo, Iowa, 1 20-ton refrigerating plant; Iloilo Ice & Cold Storage Co., Iloilo, P. I., 2 11-ton refrigerating machines and 1 10-ton ice making plant; Bristol Hotel Co., Texas, 1 4-ton refrigerating plant; Ward-Corby Co., Pittsburg, Pa., 1 30-ton refrigerating plant for Chicago branch; C. S. Grosser, Billings, Mont., 1 8-ton refrigerating plant; Southern Pipe Covering Co., Richmond, Va., 1 4-ton refrigerating plant; Ed. Erickson, Crookston, Minn., 1 4-ton refrigerating plant; Kirschbaum & Sons, Inc., Omaha, Neb., 1 11-ton refrigerating plant; Wm. Mayer & Co., Cincinnati, Ohio, 1 10-ton ice plant for New Richmond, Ohio; Myrtle Bank Hotel Co., Kingston, Jamaica, W. I., 1 8-ton refrigerating plant; Beatrice Poultry & Cold Storage Co., Beatrice, Neb., 1 40-ton refrigerating machine.

THE NATIONAL FIRE PROTECTION ASSOCIATION'S Committee on Artificial Refrigeration recommends that wherever in any system graphite can be used as a lubricant in compression cylinders, that it be done. This especially applies to air compressors used in dense air systems and for air compression for purposes other than refrigeration, as the temperature of the compression cylinders undoubtedly rises in some air systems to a point where inflammable vapors may be generated from lubricating oil. Those most advanced in the use of graphite for the above purposes, as well as for lubrication generally, advise the use of unctuous, soft, pure graphite.

AS PROOF OF THE EFFICIENCY the "Utility" Steam Specialties are giving, the Standard Steam Specialty Co. of New York has just completed manufacturing a 24-in. exhaust 5000-hp. exhaust muffler, oil separator, return tank, pump governor and feed water heater for installation at the Prudential Life Insurance Building, Newark, N. J., where a 2500-hp. Utility oil seperator is installed in an adjoining plant.

THE TRILL INDICATOR COMPANY, of Corry, Pa., confident that the country is on the verge of a business boom, has taken time by the forelock and made preparations by building a large addition to its factory. The company has been running full time and full handed during all the past winter and summer months, and has recently increased its force, with many orders ahead. The following is a partial list of recent sales: Youngstown Consolidated Gas and Electric Co., Youngstown, O.; Knight & Wall, Havana, Cuba; California Polytechnic School, San Luis Obispo, Cal.; Thompson & Ford Lumber Co., Sour Lake, Tex.; Corry Electric Light Co., Corry, Pa.; Warren Light & Power Co., Warren, Pa.; F. Hauber, Brunn, Austria; Miles A. Hoffman & Co., London, England; New England Company, Cleveland, O.; Holdrege Lighting Co., Holdrege, Neb.; Risley Bros. & Co., Jacksboro, Tex.; Star Manufacturing Co., New Lexington, O.; N. A. S. E. No. 5, Cleveland, O.

ECONOMIZERS utilizing the waste heat in chimney flue gases and other furnaces have long been used for preheating boiler feed water and for heating water for industrial purposes. Recently a similar appliance for heating air to be used for drying purposes for heating buildings or for the supply of furnaces has been brought out by The Green Fuel Economizer Co. of Matteawan, N. Y. This apparatus is fully illustrated and described in a 16-page pamphlet entitled, The Green Patent Waste Heat Air Heater, which this company is now distributing.

CLEANSING ACTION WHICH REMOVES from boiler heating surfaces scale already formed and also takes grease off is the strong feature of the Atlas Boiler Preservative E made by the Atlas Preservative Co. of New York. A booklet just issued treats of the root of boiler trouble, the requirements of efficient internal treatment and directions for use of the Atlas E Preservative so as to take out all old scale and prevent the formation of new. Interesting and convincing testimonials are also given of results that have been obtained both in this country and abroad.

IN REGARD TO THE MERITS of the Fuller & Johnston Manufacturing Co.'s Farm Pump Engine, the following letter received from the Erecting Department of the American Bridge Co., at Coleraine, Minn., is good evidence:

"I note your letter of the 21st ult. asking us as to the service we are getting out of your Farm Pump Engine which we recently purchased of you.

"We are using the engine pumping water from a 75-ft. well and running it on an average of 16 hours daily. We find that it is giving satisfactory service."

TUXEDA BRONZE FITTINGS, which are a special design embodying safety and the utmost durability, are illustrated and the prices given in a folder from Franklin Williams, manufacturer, 39 Cortlandt St., New York. He also describes the Neverust Exhaust Head, which is a durable and efficient combination of copper shell and baffles with a cast-iron base and cone. The design is such as to remove completely all condensation from the exhaust steam and passages are given such area that no noise or back pressure results.

SERVICE IS ONE OF THE chief characteristics of the Dodge Manufacturing Company, power transmission engineers and manufacturers of the Dodge line of transmission machinery, Mishawaka, Ind. This is largely based upon the maintenance of large stores and warehouses in many of the principal cities in the country, in connection with expert engineering departments, which makes possible immediate deliveries and the solution of knotty transmission problems without delay.

From time to time the Dodge people have enlarged and extended this service until it now takes in nine points, Boston, New York, Brooklyn, Pittsburgh, Philadelphia, Cincinnati, Chicago, St. Louis and London, Eng. Announcement has just been made of the addition of Minneapolis, Minn. and Atlanta, Ga. to the list. These two branches will serve the two-fold purpose of local stores and distributing stations for the Northwest and the Southland.

The Minneapolis store is located at 202-204 Third street, South and the warehouse at 312 to 320 First street, North. The agency arrangement with the Minneapolis Steel & Machinery Co., has been discontinued. Burke Richards, former resident salesman at Cleveland, O., has been promoted to manager of the Minneapolis branch.

The Atlanta branch and warehouse is located at 54 Marietta street. S. L. Dickey, resident salesman at that place has been appointed manager. No change has been made with any of the agency connections in the south.

ENGINEERING CONTRACTORS WHO have considerable water to contend with are showing keen interest in the work of the new Fuller & Johnson Bilge pump outfit. The outfit consists of a powerful air-cooled engine similar in type to automobile engines and a heavy, strong and durable Diaphragm pump with a capacity of 3,500 gal. an hour. This outfit saves 2 men's pay and is far more satisfactory than muscle-power. The cost of gasoline to operate the Fuller & Johnson Bilge pump outfit is from 12 to 15 cents for 10 hr. Descriptive circulars of the new Bilge pump outfit may be obtained by addressing The Fuller & Johnson Mfg. Co., 468 Booth street, Madison, Wis.

RECENT SALES OF ALLIS-CHALMERS electrical apparatus, exclusive of combined generating units, which constitute a large list in themselves, include the following: Merchants' Heat & Light Co., Indianapolis, Ind., 2 1000 kw. synchronous motor generator sets, 3 phase, 2300 volts, 60 cycle, a. c., 250 volts shunt wound d. c., and 1 200 kw. shunt wound balancing set, consisting of 2 125-volt machines on a common cast-iron base, Delaware, Lackawanna & Western R. R., Hampton Power Plant, Scranton, Pa., 1 1500 kva, O. F. W. C., 3-phase, 60-cycle transformers, 4150-2200 volts; San Francisco Gas & Electric Co., San Francisco, Cal., 2 1000 kw. synchronous motor-generator sets, 3 phase, 11,000 volts, 60 cycles, a. c., 275 volts compound wound d. c., Great Northern Railway Co., St. Paul, Minn., 9 induction motors, aggregating 220 hp., 440 volts, 3 phase, 60 cycles; Joseph Light & Power Co., Joseph, Ore., 1 225 kw. a. c. waterwheel type generator, 2300 volts, 3 phase, 60 cycles, with exciter and switchboard; Portland Railway, Light & Power Co., Portland, Ore., 1 500 kw. vertical direct current generator, 600 volts, with switchboard; Wind River Lumber Co., Cascade Locks, Ore., 1 100 hp. induction motor, 3 phase, 60 cycle, 440 volts; Caldwell Milling & Elevator Co., Caldwell, Idaho, 1 100 hp., 220 volts, 3 phase, 60 cycle induction motor; Pocahontas Consolidated Collieries Co., Switchback, W. Va., 1 175 hp., 2080 volt, 3 phase, 60 cycle induction motor; Toledo & Indiana Railway Co., Toledo, Ohio, 1 400 kw. rotary converter, 500 r.p.m., 25 cycle, 3 phase, 600 volts d. c., with 3 150 kva. O. F. S. C. transformers 3200-375 volts, together with switchboard; Victor Talking Machine Co., Camden, N. J., 8 type K motors, aggregating 530 hp., 220 volts d. c.; Goodyear Lumber Co., Tomah, Wis., 19 induction motors aggregating 925 hp.; Crane Co., Chicago, Ill., 1 300 kw. synchronous motor-generator set, 440 volts, 60 cycle, a. c. 250 volts d. c. and 3 100 hp. induction motors, 440 volts, 60 cycles; Great Western Power Co., San Francisco, Cal., 15 O. F. S. C. transformers, 22,000-2400 volts, aggregating 2100 kva.; Milwaukee & Fox River Valley Railway Co., 1 200 kw., 2300 volt synchronous motor, 60 cycles; Diamond Match Co., Barberton, O., 11 induction motors, aggregating 75 hp.; Illinois Steel Co., Joliet, Ill., 1 1250 kva. synchronous frequency changer, changing from 3 phase, 2200 volts, 60 cycle, to 3 phase, 6600 volts, 25 cycle, 300 r.p.m., 1 200 kw. synchronous motor generator set, 3 phase, 25 cycle, 6600 volts, 2200 volts d. c. together with switchboard; Cambris Steel Co., Johnstown, Pa., 1 500 kw. rotary converter, 3 phase, 25 cycle, 575 volts d. c.; Pacific Lumber Co., Wilmington, Cal., 17 induction motors, aggregating 510 hp.

# PRACTICAL ENGINEER CLASSIFIED ADVERTISEMENTS

Advertisements in this section are inserted under regular headings at the rates of 40 cents per line. About nine words make a line. No display type is allowed, but the first three words may be set in capital letters. Minimum space sold, two lines.

Under classification, "Positions Wanted," advertisements not exceeding four lines will be inserted for subscribers once free of charge.

To insure proper classification, copy must reach this office on or before the 15th of month preceding publication.

## Positions Wanted

POSITION WANTED—By young mechanic, 26 years of age, as motor tender or assistant in large power plant; knows the care of all kinds of electrical machinery. Oscar Woessner, 796 E. 161st st., New York City. 4-1

EXPERT CORLISS ENGINEER desires to make change in position. At present operating 3-phase plant; age 42; married; twenty years' experience; A1 references.—Address, Engineer, 4520a Rutger st., St. Louis, Mo.

POSITION WANTED—As engineer in power plant or water works; 3 years experience with dynamos, Corliss and high speed engines, boilers and pumps; employed at present; can make good. Address Harry J. Badcon, Gaylord, Mich. 4-1

POSITION WANTED—High grade salesman, age 35, desires change; experienced in steel, power machinery and heavy lines, with record proving ability to close large sales; confidential correspondence invited. Address S. S., Practical Engineer. 4-2

POSITION WANTED—Chief operating engineer wishes position as chief engineer or would consider position as chief operating engineer. At present I am in charge of railway and interurban power plant, which consists of cross-compound Corliss condensing engines, turbines and water tube boilers. Experienced with high and low speed engines; technical education; understand all makes of engines, turbines, boilers, pumps and all power plant appliances, D. C. and A. C. current dynamos, motors and rotary converters, high and low voltage transformers; age 28 and married; best of references. Address Box 41, Practical Engineer. 4-1

## Help Wanted

AGENTS WANTED to sell Burgmann celebrated engine packings in territories not yet covered. See our advertisement on page 16 of this issue. 9-tf

AGENTS WANTED—West of Buffalo and Pittsburg to sell a necessary power plant specialty that is a big money maker. We allow a liberal commission. Address, stating experience, Box 126 Practical Engineer. 3-tf

SALESMEN IN EVERY LOCALITY, who are now calling on power plant trade, to handle as side line on commission two high grade, established specialties. For full particulars, address W. T. Jameson, 100 Surrey Rd., Mansfield, O. 4-2

ENGINEERS AND MECHANICS—To make big money selling Incomparable "ZIZ" Hand Soap. A 10-cent can will instantly remove more dirt and stains from the hands than four cakes of any soap made, and it will not injure the most delicate skin. Small sample free. Byram Mfg. Co., Box 3133, Boston, Mass. 4-tf

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